Metals Review

The News-Digest Magazine

Published by the American Society for Metals

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June 1957

James B. Austin
Vice-President, Research
U.S. Steel Corp.
(See Story, P. 5)

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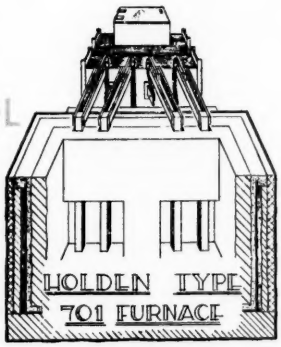

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Metals Review

The News Digest Magazine

June 1957

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National Officers Nominations, 1957-58 4
James B. Austin of U. S. Steel Corp. 5
Report on Titanium Conference 5
Educational Report From Ontario Chapter 19
Southwestern Metal Show Scheduled for 1958 25

Important Lectures

Production Metallurgy of Sheet Steel, by John S. Alter 6
Vacuum Melting, by J. S. Huntington 7
Developments in Cermets, by H. H. Hausner 9
Furnace Heat Transfer Relationships, by N. B. Jones 11
Merits of Atmosphere Controlled Furnaces Versus Salt Baths, by John C. Reid 12
Metallurgy of Zinc, by J. U. MacEwan 13
Powder Metallurgy Techniques, by George Stern 16
Operations Sea Horse, by F. L. LaQue 17
Forgings, by P. F. Adams 18
Sleeve Bearing Principles, by Edwin Crankshaw 20
Mechanical Behavior of Ceramics, by J. E. Burke 21
Copper Alloys, by R. J. Severson 23
Ultra-High-Strength Alloy Steels, by Peter Payson 24
Brittle Fracture of Welded Structures, by W. S. Pellini 26

Departments

Obituaries 8
New Films 9
Men of Metal 10
Compliments 18
Metallurgical News 27
Employment Service Bureau 72

ASM Review of Metal Literature

A — GENERAL METALLURGY 29
B — ORE AND RAW MATERIAL PREPARATION 32
C — EXTRACTION AND REFINING 32
D — IRON AND STEELMAKING 34
E — FOUNDRY 36
F — PRIMARY MECHANICAL WORKING 38
G — SECONDARY MECHANICAL WORKING (FORMING AND MACHINING) 39
H — POWDER METALLURGY 43
J — HEAT TREATMENT 43
K — ASSEMBLING AND JOINING 44
L — CLEANING, COATING AND FINISHING 47
M — METALLOGRAPHY, CONSTITUTION AND PRIMARY STRUCTURES 50
N — TRANSFORMATIONS AND RESULTING STRUCTURES 52
P — PHYSICAL PROPERTIES 54
Q — MECHANICAL PROPERTIES AND TESTS 57
R — CORROSION 62
S — INSPECTION AND CONTROL 64
T — METAL PRODUCTS AND PARTS 67
W — PLANT EQUIPMENT 69
X — INSTRUMENTATION—LABORATORY AND CONTROL EQUIPMENT 71

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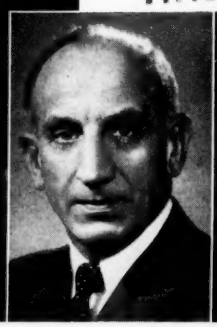
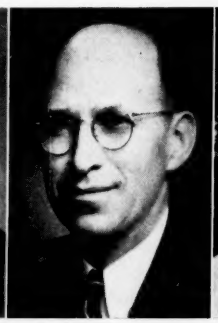
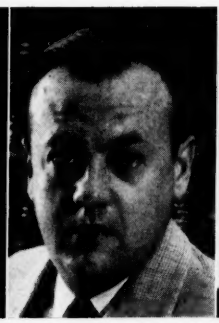
Officer Nominations 1957-1958







G. M. Young *C. H. Lorig* *R. H. Aborn* *J. Hollomon* *E. E. Stansbury*

NOMINATIONS for new national officers of the American Society for Metals have been announced by the Nominating Committee, which met in Chicago on May 21-22, under the chairmanship of R. M. Brick, Continental Can Co.

G. M. Young, currently serving as vice-president, was nominated for president, C. H. Lorig, currently serving as treasurer, was nominated for vice-president, and R. Aborn was selected as nominee for treasurer.

Two additions proposed for the Board of Trustees are John Hollomon and Eugene Stansbury.

In accordance with the Constitution of the American Society for Metals, additional nominations for any of these posts may be made by written communications addressed to the secretary of the Society and signed by any 50 members. If no such additional nominations are received prior to July 15, nominations shall be closed and at the annual meeting in November 1957 the secretary will cast the unanimous vote for the members for these candidates.

G. M. Young

G. M. Young, nominee for president, a native of Saskatoon, Saskatchewan, was educated at the University of Saskatchewan and McGill University, graduating in 1930 with a B.S. degree in metallurgical engineering. His industrial experience has taken him from metallurgical assistant at the Aluminum Co. of Canada's Toronto plant to chief metallurgist at the company's Kingston plant and finally to technical director of the company's Montreal plant, the position he holds at the present time.

Mr. Young has served as a member of the executive committee of the Montreal Chapter since 1947, as chairman of the Montreal Chapter (1951-52), and was a conferee to the First World Metallurgical Congress. He is also the author of several papers relating to the casting and fabrication of aluminum and its alloys. He is the first Canadian to be nominated for president A.S.M.

C. H. Lorig

Clarence H. Lorig, selected as nominee for vice-president, received a Ph.D. degree from University of Wisconsin in 1928. He was employed on different occasions as metallurgist for French Battery Co., Stowell Co., Ladish Drop Forge Co. and Pelton Steel Casting Co., prior to and after completing his graduate work. Later he accepted an assistant professorship in mechanical engineering at Drexel Institute. Since 1930 he has been associated with Battelle Memorial Institute, first as supervising metallurgist connected with the process metallurgy department and later as assistant director of the Institute.

Dr. Lorig has received a distinguished service citation for accomplishments in the metallurgical engineering field from the University of Wisconsin. He has made outstanding contributions to the foundry industry and stimulated and guided much research in process metallurgy. He is credited with research leading to several patents on alloys and metallurgical processes. Dr. Lorig is also the author of numerous articles and papers which have appeared in scientific and technical journals. He will complete his two years service as national treasurer A.S.M. this fall.

R. H. Aborn

Robert H. Aborn, nominee for the two-year office of treasurer, received his Ph.D. degree from Massachusetts Institute of Technology in 1925. His career in the steel industry began in the blast furnace department of Bethlehem Steel Co. in 1920. As his interest turned to metallurgical research, he joined the staff at Watertown Arsenal, and was later associated with the research laboratory of applied chemistry at M.I.T. After two years in teaching and research under Albert Sauveur at Harvard University, he joined the staff of the Fundamental Research Laboratory, U. S. Steel Corp., in 1930, of which he is now director. Among his special interests are stainless steels and welding, and in 1941 he was awarded the Lincoln Gold Medal of the American Welding Society.

In the first world war, Dr. Aborn served in the Chemical Warfare Service, U. S. Army, and in the second war was closely associated with special metallurgical research for the armed services under the Office of Scientific Research and Development.

Dr. Aborn is a past chairman of the A.S.M. publications committee and has served on the educational committee.

J. H. Hollomon

John H. Hollomon, nominee for the office of trustee, was born in Norfolk, Va. He received a B.S. degree in physics in 1940 and a Ph.D. degree in metallurgy in 1946, both from Massachusetts Institute of Technology. In 1941 he became instructor in metallurgy at the graduate school of engineering, Harvard University. He was called to active duty in the U. S. Army in 1942 and served four years as chief of the physical metallurgy section at Watertown Arsenal Laboratory, being separated as a major. He received a Legion of Merit for his work in the service.

In 1946 Dr. Hollomon became a research metallurgist at the research laboratory, General Electric Co., and was later made assistant manager. He is now manager of the research department. He is the author of sev-

Nominations (Continued)

eral papers in the field of physical metallurgy and co-author of the textbook, "Ferrous Metallurgical Design".

Dr. Hollomon was named by the National Junior Chamber of Commerce as one of America's ten outstanding young men of 1954.

E. E. Stansbury

Ele Eugene Stansbury, professor of metallurgical engineering, University of Tennessee, is a native of Indiana and, since his graduation from college, has devoted his entire time to teaching.

Dr. Stansbury, candidate for the office of trustee, is a graduate of North Carolina State College where he recevied his B.S. degree in chemistry in 1940. He earned his M.S. from the University of Cincinnati and his Ph.D. from Cincinnati in 1946.

His teaching experience includes four years as an instructor in metallurgical engineering at the University of Cincinnati. He was made assistant professor at Cincinnati in 1946 and in 1947 was made an associate professor of metallurgical engineering at the University of Tennessee, advancing to a full professorship in 1952.

Dr. Stansbury's consulting services include many of the important industrial firms in Ohio and Tennessee. He was, for a time, associated with the Metallurgy Division of the Oak Ridge National Laboratory. Publications by Dr. Stansbury include many topics covering advanced metallurgy.

James B. Austin Named Vice-President U.S. Steel Research and Technology

James B. Austin, 25th president of the American Society for Metals (1954-55), succeeds Edgar C. Bain, also a past president A.S.M. (1937-38), as vice-president in charge of research and technology for the United States Steel Corp. The announcement was made recently by Harvey B. Jordan, executive vice-president, operations. In his new position, Dr. Austin assumes top responsibility for the corporation's research and technology activities.

Graduating from Lehigh University where he received his B.S. degree in metallurgy, Dr. Austin continued graduate work at Yale University, receiving his Ph.D. degree in 1928. The same year Dr. Austin joined U. S. Steel at the Kearny, N. J., laboratories. He was made assistant director in 1944, and two years later was made director in charge of the research facilities. In 1956 the laboratories moved from Kearny to the new research headquarters in Monroeville, Pa., where Dr. Austin was made vice-president of fundamental research.

The 1944 chairman of New York Chapter, Dr. Austin also presented the Campbell Memorial Lecture in 1946 on the "Effects of Changes in Condition of Carbide on Some Properties of Steel". He also delivered a series of educational lectures in 1941 which the A.S.M. published as "The Flow of Heat in Metals".

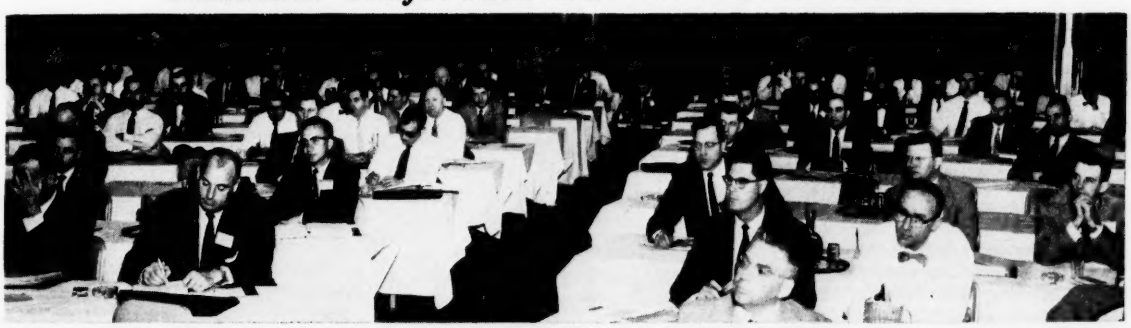
In 1950 Dr. Austin was elected to a two-year term as trustee A.S.M. and as vice-president in 1952. He was elected president in 1953 and became president of A.S.M.'s Foundation for Education and Research immediately upon his retirement as president A.S.M.

Dr. Austin is author of numerous papers and has done considerable research on, among others, chemical thermodynamics, thermal expansion measurements on metals and refractories, adsorption of gases on plane surfaces of metals and flow of heat in refractories and metals. He has lectured before many A.S.M. chapters on the same subjects. As a research executive, his primary concern now is in seeing that whole programs mature rather than doing specific research himself.

He has been a trustee for the American Ceramic Society, and vice-chairman of the Iron and Steel Division A.I.M.E., as well as a member of the executive committee of the Institute of Metals Division A.I.M.E.

Jim, his wife Janet, and their children, Peter, age 18, and Winifred, age 15, enjoy horseback riding, playing the piano and singing, and gardening. Dr. Austin is a member of the Pittsburgh Chapter.

Titanium Conference Has Record Attendance



Registrants Enjoy Uncrowded Classroom During Seminar on Titanium Held During the Western Metal Show

Enthusiastic approval greeted the conclusion of the A.S.M. Titanium Conference, conducted by the Metals Engineering Institute during the recent Western Metal Congress. The subject of titanium was discussed for five days from many angles, with chief emphasis on fabrication.

Over 40 speakers presented papers on topics ranging from casting and powder metallurgy to sheet rolling, forging and welding. Numerous production problems were discussed, and fabricating techniques of different companies were compared.

Practically all the lectures were reproduced and distributed to the 150 registrants, who came from four foreign countries and more than half of the 48 states. A limited number of files of the papers presented may be purchased by companies who were unable to send representatives to the Conference.

Comments from the participants indicated hearty endorsement of the classroom-type symposium and recommended more such meetings on this and other metallurgical subjects. Plans for the A.S.M. of Tomorrow call for an auditorium and dormitories at the projected new suburban headquarters. Similar conferences will be held at regular intervals and will serve another need of the metals industry—that of providing an opportunity to train and update engineers and metallurgists on modern concepts and techniques.

The A.S.M. Titanium Conference made it quite clear that titanium has joined the ranks of today's large-scale engineering metals. Costs continue to drop as production tonnages increase and control of impurities is perfected. Titanium is finding widespread acceptance in missiles and manned aircraft, as well as in chemical industries and such unusual fields as electronic and surgical applications.

Describes Metallurgy of Sheet Steel

New Jersey Chairman J. J. Hauptly (Left), Is Shown With John S. Alter, Assistant Manager, Sheet and Strip Metallurgy, U. S. Steel Corp., Who Spoke on "Production Metallurgy of Sheet Steel" at a Recently Held Meeting

Speaker: John S. Alter
U. S. Steel Corp.

John S. Alter, assistant manager of sheet and strip metallurgy, U. S. Steel Corp., presented a talk on "Production Metallurgy of Sheet Steel" at a meeting in **New Jersey.**

Mr. Alter briefly touched on the current programs that U. S. Steel is conducting to educate their customers in production metallurgy and the most economic use of sheet steel. He also described the strides that industry has made from 1926 to the present day to satisfy the fast-growing requirements for sheet and strip steel, pointing out that in 1926, 6 million tons or 16% of the major steel production went into sheet and strip, and today, 30 million tons or 35% of the steel produced can hardly satisfy the need.

The speaker described the production of hot rolled sheet and coil and their place in industry. Metallurgical properties are best determined by a combination of grain size, tensile properties and Rockwell hardness. Hot rolled commercial quality may have a hardness of Rockwell B 70, whereas drawing quality hardness may range between B 45 and 60, depending on thickness and properites required for end use. Hot rolled sheets are generally suitable for applications where normal surface defects are not objectionable and a good finish is not the prime requirement.

Mr. Alter then discussed cold rolled sheet in detail. He pointed out that both metallurgical and surface properties are superior to those of hot rolled sheet, making it more suitable for exposed parts requiring a good surface. The material also exhibits better flow characteristics which permit easier forming. Light slivers, pits, pinchers and floppers, when found in relatively small quantities, are considered normal. Abnormal defects are welds, holds, scabs, slivers and outside and inside wraps. Generally, cut length sheets will not have any clearly visible abnormal defects, whereas coils may have some.

Various grades of cold rolled steel were discussed. Commercial quality, usually produced from rimmed, capped, or semikilled steel, does not have the uniformity of chemical composition and mechanical properties which are required for the more difficult draws. Drawing quality will usually provide the answer to this problem. Should this material fail to provide satisfactory results, drawing quality special killed steel should be used. Since this material is killed with aluminum, strain aging does not occur once the initial yield point is removed and does not return on storing at room temperature. This grade is used when material is required to be free of surface disturbances, such as stretcher strains, without roller leveling immediately prior to use, or when it is required that the steel not undergo any significant changes in mechanical properties over a period of time.

Included in Mr. Alter's discussion of cold rolled sheet was the problem of stretcher strains and what can be done to avoid this condition. Material such as annealed rimmed steel has the property of yielding under stress and then continuing to yield at a stress lower than that required for the first plastic flow. Stretcher strains will develop when the material is formed or stamped; its susceptibility to do so may be removed by cold working the sheet before drawing. Light temper rolling or roller leveling is generally employed. Temper rolling with a reduction or extension of 1 to 2% is usually effective in eliminating the tendency to stretcher strain. The effect of this cold work is not permanent. The sheet, if allowed to age at room temperature for some time after being worked, will show stretcher strain upon drawing. The rate at which the stretcher strain conditions return depends on the per cent extension during temper rolling and the temperature during the time following the rolling.—**Reported by Alfred J. Spitzner for New Jersey.**

Describes Koldwelding at Louisville Chapter Meeting

Speaker: H. B. Wellar
Utica Drop Forge Co.

Howard B. Wellar, sales engineer, Utica Drop Forge Co., spoke on "Process and Applications of Koldwelding" at a meeting held by **Louisville Chapter.** This was student affiliation night and the meeting was well attended by student members from the University of Kentucky.

Mr. Wellar explained this very interesting process in which cold metal through pressure is bonded into a joint which is as strong as the parent metal. Aluminum and copper are the principal materials being joined by the process at present. The speaker stressed cleanliness of the materials at the location where the weld is to be made.

Many applications for koldwelding are now being found. These chiefly involve butt welding of small rounds and lap welding of thin sheets. Mr. Wellar mentioned, however, that larger sections can be welded if sufficient pressure is available. In many cases the extreme pressure required would not always justify the massive equipment necessary.

In the concluding portion of the presentation, Mr. Wellar demonstrated some of the koldwelding equipment which is now being produced by his company.—**Reported by C. C. Jenkins for Louisville.**

Gives Talk on Vacuum Melting at Baltimore

Speaker: J. S. Huntington

Utica Drop Forge & Tool

John S. Huntington, assistant to general manager, Metals Division, Utica Drop Forge and Tool Division, Kelsey Hayes Co., spoke on "Vacuum Melting" at a meeting of the **Baltimore Chapter.**

Vacuum melting has been in production approximately five to seven years. Therefore, it is not an untried process. The three types of vacuum melting are vacuum induction, consumable electrode and vacuum degasification. Each requires different equipment but all are operated in a vacuum.

The vacuum induction method deoxidizes the metal, removes dissolved gases and boils away the elements with high vapor pressures which are normally the impurities. The alloying elements are added after the gases are removed and deoxidation is complete. Therefore, the possibility of the alloying metals reacting with the gases is eliminated. The close control over the chemistry of the metal is an important factor in vacuum induction melting. Casting structure is not affected by this process, and a sound casting is not the primary purpose of the process.

The advantage of the consumable electrode method is the good ingot structure which is obtained. The inclusions are dispersed throughout the entire casting. The chemistry of the ingot in this method is basically the same as the initial charge, but the gas content may be lower. One disadvantage of the consumable electrode method is that the addition of alloying elements is difficult.

The vacuum degasification process is used where the removal of gases is the primary object. It reduces the hydrogen and nitrogen content considerably, which aids in elimination of flake formation in the ingot.

The vacuum induction melting process has been used successfully to produce alloys with high-temperature strength. This is due to the close control over chemistry of the final ingot.

Several test heats of nickel-base alloys were made by the normal process (melted in air) and compared with vacuum induction test heats of the same alloys. The stress rupture life of the vacuum melted alloys was longer, and ductility remained good.

Vacuum melting has proved that trace elements can have a very important place in the chemistry of metals, and it has been proven that the ductility and stress rupture life of nickel-base alloys containing 20 parts per million of boron is improved. Over 180 parts per million of boron cause forging difficulties.

Bearing steel fatigue life has been improved by the cleanliness of vacuum melted ingots.

When vacuum melting was introduced, it was only applied to the existing alloys. Recently, alloys are being developed specifically for the vacuum melting process. Vacuum melting may be a help where the process and desirable properties of a steel are understood, but it is not a cure-all for every problem.

When cleaner, gas-free metal having close chemistry tolerances is needed, the vacuum melting process can be applied.—**Reported by G. M. Hinton for Baltimore.**

Columbia Hears Talk on Salt Brazing of Aluminum

Speaker: Al Fairchild

Western Electric Co.

The growing demand for more metallurgical control in the salt brazing of small aluminum parts was brought out by Al Fairchild, metallurgist, Western Electric Co., in a talk on "Salt Brazing" at a meeting held by the **Columbia Chapter.**

Precleaning and the precision clearance to be obtained in mating the parts to be brazed were emphasized. Mr. Fairchild brought along test samples of brazed aluminum parts which illustrated the effects of the proper and improper clearances.

X-ray pictures showed voids and burned-out spots between the two joined pieces that had improper clearances and also showed good bonding joints on the parts that were properly cleaned and had proper clearance.

Mr. Fairchild discussed in some detail the heat treating effects provided by the salt bath at 1100° F. He also explained distortion control.

In a short "coffee talk" preceding his technical discussion, Mr. Fairchild discussed "Organization of an A.S.M. Chapter". — **Reported by James L. Evans for Columbia.**

Chipman Granted Priestly Scroll

John Chipman (Left), Professor and Head of the Department of Metallurgy, Massachusetts Institute of Technology, Is Shown Receiving the Priestly Scroll as the 31st Annual Priestly Lecturer at The Pennsylvania State University. M. A. Farrell, vice-president of research, presented the scroll on behalf of the University at a banquet held for Dr. Chipman

The 31st Annual Priestly Lectures at the Pennsylvania State University were presented by John Chipman, professor and head of the department of metallurgy at the Massachusetts Institute of Technology. Dr. Chipman's main interests lie in the application of physical chemistry to metallurgical problems and his many studies in this area have contributed greatly to our knowledge of the chemistry involved in many common metallurgical operations. The general topic of his five lectures was "Chemistry in the Metallurgy of Iron and Steel". Individual subjects of the lectures were: Oxidation and Reduction in Molten Iron, Henry's Law in Metals, Metallurgical Slags, Hydrogen in Steelmaking, and Dephlogisticated Air in the Steel Industry.

Dr. Chipman's research has been recognized by many awards including the Howe Medal of the American Society for Metals, the Losana Gold Medal of the Swedish Academy of Engineering Sciences, and the Bessemer Gold Medal of the Iron and Steel Institute. He is a past-president A.S.M.

This annual lecture series is sponsored by the Mu Chapter of Phi Lambda Upsilon, honorary chemistry fraternity, in honor of Joseph Priestly. As in the past the collected lectures are available through Mu Chapter.

Presents Talk on Selecting Materials

Joseph Gurski, Assistant Manager, Process Development Department, Ford Motor Co., Spoke on "Economics in Materials Selection" at a Meeting of Chicago-Western Chapter. Shown are, from left: A. F. Koctur, chairman of the chapter; Mr. Gurski; and S. R. Callaway, the technical chairman

Speaker: Joseph Gurski
Ford Motor Co.

Joseph Gurski, assistant manager, process development department, Ford Motor Co., recently addressed a meeting of the **Chicago-Western Chapter** on "Economics in Materials Selection". Mr. Gurski emphasized the important role that materials selection can play in cost reduction, particularly in high-volume production.

In the present highly competitive society, it is necessary for the metallurgist, as well as other engineers and production men, to be alert for cost-saving opportunties. Metallurgists are concerned because of the constantly fluctuating material pricing situation. Mr. Gurski pointed out that materials specified by engineering departments should provide as many options as possible for manufacturing. In this way, those ordering the material for production can select the most economical material that will satisfy engineering requirements of service performance.

Savings can run into impressive figures in high-volume production. For example, if the cost of 1,500,000 units could be reduced by only .01c each, a saving of $15,000 would result. These units could be automobiles, toasters, or any other product.

Complex mechanisms, such as automobiles, present the cost-conscious engineer with many opportunities for savings for his company. Mr. Gurski gave as an example piston pins cold formed from bar stock instead of machined from tubing. A tremendous saving resulted from this particular change.

The steel in Ford axle ring gears has been changed several times to keep pace with the changing steel price situation. Substitutions are not made arbitrarily, of course, but only after engineering test work, machining pilot lots, etc., to be sure that total cost is held down to a level consistent with product quality.

Mr. Gurski cited numerous examples of savings. Such things as dimensional tolerances on sheet steel, and improved radiator design to simplify assembly were among other items discussed.—**Reported by D. J. Wulpi for Chicago-Western.**

OBITUARIES

WILLIAM J. MURPHY, a charter member of A.S.M., died in April as the result of a heart condition with which he had been ill for several months. Last December he was elected vice-president of the Ferry Cap & Set Screw Co., Cleveland. He joined the company in 1909, and was foreman of the heat treating department, later becoming factory manager. Mr. Murphy was well known throughout the trade and recognized in the industry as an authority on heat treating.

♦ ♦ ♦

CARLTON G. LUTTS, 66, of Cabot Farm, Salem, Mass., which he developed, died Apr. 17 in Orlando, Fla. He was born in Malden, Mass., later lived in Lynn, Mass., and completed his education at the University of Maine.

The greater part of his working years was spent at the Boston Naval Shipyard in charge of the materials and the chemical laboratories. He was co-inventor of an anchor chain which is standard equipment on all naval ships and many commercial lines, and he developed a number of improved methods of producing and inspecting castings, particularly very heavy ones. He was responsible for a process to electrically weld chain and throughout the Navy was considered an authority on the manufacture of chain and rope.

Through publication of his work and lectures given to professional groups and naval graduate students at Massachusetts Institute of Technology, it has been said that the stature of the Boston Naval Shipyard and the entire Navy has been greatly enhanced. Mr. Lutts earned two commendations, as well as numerous other awards, for outstanding services, including the Navy Meritorious Civilian Service award. He was an active member of A.S.M., and belonged to several other technical societies.

Mr. Lutts had retired Apr. 30 last year.

♦ ♦ ♦

A. C. GUNSAULUS died suddenly about a week after a surgical operation in Cuyahoga Falls, Ohio.

A 34-year veteran of the Goodyear Aircraft Corp., Mr. Gunsaulus joined the company as a member of the aero-engineering department shortly after the formation of the Aero Division by the Goodyear Tire & Rubber Co. He was employed in various engineering capacities, transferring to Goodyear Aircraft in 1942. At the time of his death he was manager of the wheel and brake development department. He had been an ordnance officer during World War I and graduated from Iowa State College with a bachelor of science degree in mechanical engineering. He was a charter member and a past chairman (1948-1949) of the Akron Chapter.

♦ ♦ ♦

RALPH V. HILKERT, 41 was the victim of a fatal automobile accident early in April. Born in Chicago, he received a B.S. degree from DePaul University and also attended the University of Alabama. He worked as a development metallurgist in research with several companies, was an instructor in metallurgy at the Illinois Institute of Technology, and at the time of his death was chief, physical metallurgy, Titanium Alloy Manufacturing Div., National Lead Co. He is survived by his wife and six children.

Take Over Math Classes

The annual meeting of the Philadelphia Mathematics Teachers Council which was held late in March resulted in the absence from classes of virtually all mathematics teachers in the Philadelphia schools on the day of the meeting. By prior arrangement with the Technical Societies Council of the Engineers Club and its affiliated societies, about 75 members of these societies, including 21 A.S.M. members, took over all of these mathematics classes for the day. The opportunity was used for career guidance and lecturing on the subject of career opportunities in science and engineering.

New Films

Aluminum on the March

A 28-min. movie, produced by Jim Handy Studios for Reynolds Metals Co., deals with the uses of aluminum in every phase of modern living. The camera moves from bauxite mines to rolling mills, showing how aluminum is mined, reduced from powder to metal, cast, rolled, extruded, pressed, coiled and shaped into countless end-products from packaging foil to airplane wings. The film may be obtained through Association Films, Inc., with exchanges in Ridgefield, N.J., La Grange, Ill., San Francisco, Calif., and Dallas, Tex.

Aluminum in Modern Architecture

A Reynolds Metals Co. film produced by Richard de Rochemont and running 13½ min., is a camera report on how aluminum architectural products are revolutionizing concepts of design for modern buildings. It can be obtained through Association Films, Inc., with exchanges as listed above.

How to Select the Right Grinding Wheel

A Norton Co. film which explains the meanings of typical grinding wheel markings and shows the variations of each unit symbol. The film also develops recommended grinding wheel specifications for two different and specific grinding jobs step by step so the viewer has a clear understanding of the reasons why.

This 16-mm. sound and color film runs 30 min. and may be booked through Norton Co., Worcester 6, Mass., or any Norton district office.

Modern Methods for Joining Metals

A 20-min. sound and color film which illustrates the importance of the welding engineer in industry, as well as a variety of welding processes and applications. It also shows the many factors involved in electric welding, and how research, development and engineering serve to provide better methods and equipment. Make arrangements for the film through: Linde Co., 30 East 42nd St., New York 17, N.Y.

Describes Instrumentation

Speaker: R. B. Bonsall

Minneapolis-Honeywell Regulator Co.

Members of the **Syracuse Chapter** heard a talk entitled "New Instrumentation for the Control of Electrically Heated Furnaces" by R. B. Bonsall, application engineer, Metals Processing Division, Minneapolis-Honeywell Regulator Co., at a meeting held recently.—**Reported by G. F. Trojanowski for Syracuse.**

Santa Clara Chapter Receives Charter

The Charter Meeting of the 103rd Chapter of the American Society for Metals Was Held Recently in Palo Alto, Calif. National Secretary W. H. Eisenman presented the Santa Clara Chapter Charter to Ralph Parkman, chairman, and then gave a talk on "The A.S.M.—Past, Present and Future". National President D. S. Clark talked on "What Dynamic Laboratory Tests Mean to Us". Shown are, from left: Dr. Clark; Prof. Parkman, and Mr. Eisenman. (Reported by H. T. Sumsion for Santa Clara Chapter)

Outlines Developments In Cermets at Muncie

Speaker: H. H. Hausner

Penn-Texas Corp.

Henry H. Hausner, general manager of the Nuclear Engineering Division, Penn-Texas Corp., addressed the **Muncie Chapter** on "Cermets—Principles and Latest Developments".

Dr. Hausner defined cermets as being powder metallurgical products consisting of ceramics and metals. The most frequently used forms of metals have been oxides, carbides, borides and silicides. They have been combined with ceramic materials in an attempt to combine the most favorable characteristics of both by retaining the ductility, toughness and versatility of the metals as well as the high-temperature strength and higher melting points of the ceramics. The types of cermets which have been produced may be classified by type as coated metal, laminated structure, impregnated ceramic, sintered powder and fiber composite. Of these, the laminate type seems to offer the greatest possibilities, as does the fiber composite which is quite new.

During the last few years most cermets consisted of a major ceramic and a minor metallic component. The results were not according to expectations. It seems that the opposite way should be tried in the future, i.e., cermets should consist of a higher percentage of high-temperature resisting metals and alloys plus a smaller percentage of the ceramic component, in which mixture a reaction between the two components should take place. This type of development started with the well-known SAP material (aluminum plus aluminum oxide), and offers much promise.

Applications for use of cermets include gas turbine parts, cutting and drilling tools, electrical resistors and metal-ceramic seals. Their applications are limited as yet by expense and various other problems among the types that have yet to be overcome.

During the discussion of internal structure and composition, it was pointed out that, while much has been observed from a physical standpoint, actually there is no fully developed theoretical concept. Much work is left to be done in this field, and possibly a special type of engineer will have to be developed, combining the knowledge of the metallurgist, physicist and ceramic engineer.—**Reported by Paul Lewis for Muncie Chapter.**

Talks on Radiation Effects

Speaker: W. H. Keeler

Civil Defense Agency

William H. Keeler, director, medical and health services commission, Civil Defense Agency, presented a talk on the "Radiation Effects of Nuclear Explosions" at a meeting held recently by the New Haven Chapter.—**Reported by James L. Baker for New Haven.**

Past Chairmen Meet in Oak Ridge

Past Chairmen Who Attended a Meeting of Oak Ridge Chapter During Which National Treasurer C. H. Lorig, Battelle Memorial Institute, Talked on the "Fruits of Metallurgical Research", Included, From Left: E. E. Stansbury, J. R. McGuffey, E. C. Miller, W. T. Carey and L. K. Jetter

Speaker: C. H. Lorig
Battelle Memorial Institute

C. H. Lorig, assistant director, Battelle Memorial Institute, and national treasurer A.S.M., presented an informative discussion on "The Fruits of Metallurgical Research", at a meeting of the **Oak Ridge Chapter.**

Dr. Lorig outlined how continuous research has brought about improvements in the physical properties of the high-temperature materials of today and pointed out some of the problems confronting the aircraft and power generation industries.

Advances through research were pointed out in the aluminum, magnesium, steel, titanium and molybdenum alloy fields. A few of the points touched on were:

The addition of thorium with or without zinc to magnesium results in alloys of superior quality, such as alloys of the HK-31-T6 type.

The use of sintered aluminum powder alloys, known as SAP alloys, has pushed the useful temperatures of aluminum upwards. These alloys purposely contain as much as 12% Al_2O_3.

The wonder metal, titanium, has found a niche in the moderate temperature field, but the alloy uses are still somewhat limited by variations in properties, high costs and H_2 embrittlement.

The stainless steels, especially the precipitation hardening alloys, appear to be useful to about 1000° F. The martensitic grades are sometimes subject to sigma formation and 885° F. embrittlement.

The molybdenum alloys show great promise, but the existing alloys have poor oxidation resistance and must be clad for high-temperature service.—**Reported by A. Goldman for Oak Ridge.**

Describes Gas Turbine Metallurgy

Shown at the Speakers' Table at a Meeting Held by the Peoria Chapter Are, From Left: Ray Hays, Program Chairman; John St. John, Secretary-Treasurer; J. G. Frantzreb, Vice-Chairman; D. K. Hanink, Chief Metallurgist, Allison Division, General Motors Corp., Who Gave a Talk on "Gas Turbine Metallurgy"; A. L. La Masters, Chairman; R. R. Robinson, Technical Chairman; and G. E. Burks, Caterpillar Tractor Co. (Report by J. Ragee)

MEN OF METAL

Andrew J. Snow has been promoted to sales manager of the Furnace and Oven Division of W. S. Rockwell Co., Fairfield, Conn. Mr. Snow was formerly sales engineer with the company.

Three appointments have been announced by Mixing Equipment Co. Inc. LEWIS H. MAHONEY has been promoted from assistant sales manager to director of technical sales, JAMES A. MASON, former senior application engineer has been advanced to chief application engineer, and DONALD M. ROWE has been named senior application engineer.

H. T. ROSS, manager of engineering since 1955, has been named vice-president of engineering for Linde Co., a division of Union Carbide.

CARL R. ROWE has been named plant manager of Olin Mathieson Chemical Corp.'s rolling mill at Omal, Ohio. He comes to this position with a background of more than 20 years experience in the aluminum industry.

RUSSELL SCHLEGEL has been appointed general sales manager for Western Electrical Instrument Corp., of Newark, N. J., to supervise all product and field sales. JOHN R. HEMION transfers from the Weston, N. J., district sales office, which he managed for many years, to be assistant to the general sales manager.

Alexander Alexander has been appointed finishing engineer for Hanson-Van Winkle-Munning Co. in the Chicago area. He will assist salesmen in 15 midwestern states with the problems of buffing and polishing metals and plastics.

American Smelting and Refining Co. has announced the appointment of Joseph D. Allen, Jr., as chief technical sales engineer for the Eastern District of Federated Metals Division. He will devote much of his time and effort toward the development of better metallurgical and casting practices in the foundry, die casting and white metal industries.

John V. Betz, formerly with the Gar Supply Co., has been appointed sales representative in the New York area for the Wolverine Tube Division of Calumet & Hecla, Inc. William Bothwell, aluminum representative in the general sales offices, goes to Louisville as sales representative, replacing Jack Sheehan, who has been promoted to manager of wholesaler sales for Wolverine.

MEN OF METAL

Arthur J. Buckley, who joined Pangborn Corp. in 1952 as assistant sales manager, has been promoted to general sales manager.

Misco Precision Casting Co. announces the appointment of Edwin D. Chapman as manager of the experimental division, Muskegon, Mich. Emery E. Kuhary becomes chief engineer, and Joseph W. Campau will manage the Detroit Division, succeeding Joseph H. Cadieux who was recently appointed vice-president of manufacturing.

Edwin G. Clarke has been appointed vice-president in charge of European operations by Acheson Industries, Inc., a position newly created because of increased demand for their products abroad. He has been with Acheson for 35 years and will continue to make his headquarters in London.

Basic Inc. has appointed David M. Flynn to the company's sales and service staff in the Cleveland office, where he will work on service assignments in all sales districts.

Fred L. Fox, assistant general sales manager, Superior Steel Corp., has been given responsibility for sale of the company's alloy and spring steel products. He continues to be in charge of sales of clad metals and bullet cups.

Karl H. Fleishour, former general foreman of Copperweld Steel Co.'s rolling mills, has been appointed superintendent of the bloomers and billet mills, and William Bowker, Jr., who has been foreman of the 21-in. mill, has been promoted to assistant superintendent.

John W. Freund, sales engineer in the Detroit office of Koppers Co. Inc., has been promoted to Western district manager for the Metal Products Division and will make his headquarters in San Francisco.

Alco Products, Inc. has named F. X. Gaenger marketing manager for atomic energy projects, for the purpose of formulating marketing objectives and provide an atomic energy product service.

David M. Gaskill has been appointed manager of industrial equipment sales for Brush Electronics Co., a division of Clevite Corp.

G. A. Godwin, general manager of the Mallory Metallurgical Divisions, and Edward L. Nung, general manager of the Mallory Electronics Divisions have been elected vice-presidents of P. R. Mallory & Co. Inc., Indianapolis.

Past Chairmen Guests at Worcester

Shown at the Past Chairmen's Night Meeting Held by the Worcester Chapter Are, From Left: Herbert D. Berry, Thomas Smith Co.; H. J. Elmendorf, American Steel & Wire Division, U. S. Steel Corp.; R. I. Belmont, Bay State Abrasive Products Co.; R. S. Morrow, Universal-Cyclops Steel Corp.; L. G. Shaw, Pratt & Inman, present chairman; Joseph C. Danec, Norton Behr-Manning Overseas, Inc.; L. G. Field, Greenman Steel Treating Co.; Wendell J. Johnson, Massachusetts Steel Treating Corp.; John A. King, Carborundum Co.; and Paul F. Pfau, Arwood Precision Casting Corp.

Explains Furnace Heat Transfer Relationships At Meeting in Milwaukee

Speaker: Norman B. Jones
General Electric Co.

Norman B. Jones, sales and application engineer, industrial heating department, General Electric Co., spoke to members of the **Milwaukee Chapter** on "Typical Industrial Furnace Heat Transfer Relationships".

Mr. Jones gave examples of typical time-temperature relationships for the heating of material of different cross sections to several different furnace temperatures under equilibrium conditions.

The speaker emphasized the economies that can be effected by using "gradient" heating by pointing out that the time required to bring the center of a piece of steel to 1000° F. may be reduced to approximately 8 to 1 by using a furnace temperature of 1600° F. as compared to 1000° F. When applying this principle of increasing the rate of heating by using a thermal head to production methods, due consideration must be given to the possibilities of overheating the material in the event of improper operation. For example, in heating continuous tin plate steel strip by the "gradient" method, consideration must be given to what will happen to the material if the line should be suddenly stopped. Also, if a holding time at temperature is required in connection with the use of "gradient" heating, then separately baffled chambers with proper temperature control are necessary.

The effect of mass, spacing of charge and furnace loading were then discussed. As loading density is increased, the accompanying shielding results in less exposed surface which proportionately decreases the heating rate. The increase in heating time is normally in proportion to the increase of lead density with the net result being that this has little effect on the actual furnace output in pounds per hour. Charts were shown indicating how the output from various types of furnaces can be predicted fairly accurately by rule of thumb methods involving a relationship between the furnace operating temperature and the output in pounds per square foot per hour of hearth area.

Mr. Jones concluded his talk by citing examples of what happens to production furnaces when malfunction of the control occurs and the heat transfer process "runs wild". The importance of having a circuit breaker or separate contactors for interrupting the power flow when over - temperature occurs was stressed.

Mr. Jones brought out that heat transfer problems as related to furnace work can generally be solved by relatively simple calculations.—**Reported by Joseph C. Truszynski for Milwaukee Chapter.**

ASM is the largest publisher of books for the metals industry in the world.

Baltimore Gives Atomic Reactor Course

The Baltimore Chapter Has Recently Completed a Series of Educational Lectures on "Atomic Reactors", Which Included Talks on Problems of Reactor Materials, Reactor Fuel Elements, Liquid Metals and Corrosion Problems, Radiation Damage, and Fabrication and Testing Methods. Shown are W. D. Manly, Oak Ridge National Laboratory; and W. A. Maxwell and F. Hittman, Nuclear Division, Glenn L. Martin Co., three of the speakers

Compares Merits of Salt Baths and Atmosphere Controlled Furnaces

Speaker: John C. Reid

Canadian General Electric Co.

J. C. Reid, sales manager for industrial heating equipment, Canadian General Electric Co., addressed the **Ottawa Valley Chapter** on "Some Relative Merits of Atmosphere Controlled Furnaces Versus Liquid Salt Baths".

Some of the reasons which have necessitated efficient heat treating practices and hence efficient furnaces to do the job were outlined. These include the increased use of heat treated parts, and economy, which demands efficiency of operation, low machining costs, distortion control and, in general, a low percentage of rejects.

The source of energy depends to a large extent on the cost per B.T.U., and, in Canada, the low cost of electrical power is favorable to the use of the electric furnace. Today, the percentage of installations per year which are electrical has increased to 30% from 10% a few decades ago, and the electrical source is continuing to gain widespread acceptance, both for product quality and for economy.

The basic requirements for salt bath heat treating operations are a furnace to austenitize, a furnace to contain the quenching medium and a furnace in which to temper to the required hardness.

Heating in atmosphere controlled furnaces is effected mainly by radiation, convection and conduction, whereas in salt bath furnaces the heating is effected entirely by conduction.

Radiant furnaces are used safely and accurately at higher temperatures with good resistor life in a controlled atmosphere. Externally heated salt bath furnaces are limited to 1550° F. for neutral salts and 1600° F. for carburizing salts. For higher temperatures and production, electrode furnaces are recommended. Nitrate-nitrite salt mixtures are used over a range of temperatures from 350 to 1100° F. for isothermal quenching and tempering. Therefore, salt baths are particularly adaptable to the extremely important isothermal treatments such as austempering, martempering and cyclic annealing. Fixturing of the work is simplified if all furnaces used in this treatment are the salt bath type. However, contamination of the austenitizing salt must be avoided by thorough washing of fixtures after quenching. Also, carryover of chloride salts into the quenching furnace reduces fluidity of the nitrate-nitrite salt and, consequently, its effectiveness. Therefore, the quenching furnace must be designed as a heat extracting and quenching device and cannot be merely a converted draw furnace. A salt extraction apparatus is also included to remove the chloride salts.

In summary, it was pointed out that no one type of furnace is best suited in all cases. For example, a radiant furnace of a definite rated capacity at a certain high temperature will be inefficient when used at a lower capacity and temperature. Here a high recirculation or salt bath type of furnace will be much more efficient. However, an article such as coiled tubing which will trap salt will eliminate the salt furnace as a practical device.

Metallurgical requirements might necessitate either one type or the other, that is, salt bath for arrested quench, and atmosphere furnace for involved heating and cooling cycles such as malleablizing of white iron.

Slides illustrating modern types of furnaces of both types were shown and their respective advantages with regard to operation, results, speed of heat transfer, automation, and quality of finished work were explained. **—Reported by R. D. McDonald for Ottawa Valley.**

Calumet Hears Clark on Dynamic Tests

Donald S. Clark, National President A.S.M., Presented a Talk Entitled "What Do Dynamic Laboratory Tests Tell Us" at a Meeting Held Recently by the Calumet Chapter. Pictured are, from left: W. Hemingway, technical chairman; Dr. Clark; and P. H. Booth, chairman of the chapter

Golden Gate Executive Committeemen Meet

Members of the Golden Gate Executive Committee Are Shown During a Meeting Held Recently. Seated, from left, are: E. W. Milburn, treasurer; W. C. Matheson, chairman; H. E. Krayenbuhl, secretary; R. M. Beard, vice-chairman. Standing, from left, are: E. R. Babylon, W. J. Ericksen, Robert Nichols, T. M. Swanson, Robert L. Ray, Jack Washburn, Lester E. Habben, M. J. Kawaguchi, and Sutherland Hutton

Briefs Quebec Members on The Metallurgy of Zinc

Speaker: J. U. MacEwan

McGill University

J. U. McEwan, professor, McGill University, talked at a joint meeting of the Canadian Institute of Mining and Metallurgy and the **Quebec Chapter** A.S.M. on the subject "Production Metallurgy of Zinc". He discussed not only theory and current production methods but also the likelihood of Canadian expansion in the industry.

Very few zinc artifacts remain today because the metal is reactive and corrodes easily. As a result its history is not very well known. Zinc, as well as brass, was introduced to Europe from the Orient. It is also interesting to note that the first zinc produced in Europe was exported to the Orient. The largest part of present world production is used in North America to galvanize iron.

Nearly all zinc is produced from sphalorite—zinc sulphide—a very stable compound. Both the basic production methods, pyrometallurgical and electrolytic, require roasting of the sulphide to an oxide. The roasting is difficult because the sulphur must be reduced to a low level. Many different roasting methods are used, the choice being governed by the type of reduction planned.

The classical method of reduction is pyrochemical. The oxide was reduced with coal in a retort and the zinc vapor condensed. The resultant carbon dioxide was reduced to the monoxide and allowed to escape to the atmosphere. Most of the basic process developments have been made by New Jersey Zinc and are based on more efficient heating of briquetted zinc oxide and coking coal and recovery of the monoxide. Very little skilled labor or "muscular metallurgy" is required.

The electrolytic method is a result of recent research by Anaconda and Consolidated Mining, a U.S. and Canadian joint development. While theoretically simple, a great many difficulties had to be overcome. The most important philosophical development was the introduction to metallurgy of new concepts of purity and the effect of traces. All traces of germanium, arsenic, copper and cobalt must be removed. Germanium is one of the most difficult to contend with and is usually avoided by selecting ore. The elimination of cobalt also needed some reoriented thinking. The standard laboratory method for quantitative analysis was applied on a production scale. Cadmium is usually recovered for its market value.

In Canada the principal method used for reduction is electrolytic. The zinc is exceptionally pure, the lowest grade produced in the country is 99.97%. As far as the province of Quebec is concerned, all the known sources of ore are suitable for any of the production methods. Although some zinc is mined, it is all exported as concentrate.

During 1955 Canada mined about one-fifth of the world supply of zinc, only one-seventh of the production was consumed within the country. While it is easy to export concentrate to the south, the speaker doubted if the pure metal could be sold as easily on a long-term basis. For this reason he doubted if there would be much expansion in the near future.

In the discussion period following the talk, it was tentatively concluded that the expansion of zinc production facilities was governed primarily by the uncertain market condiitions. The relative merits of the different grades of zinc used for galvanizing was also discussed. The local galvanizing industries preferred relatively pure zinc (electrolytic or rectified Prime Western). Certain factions of the zinc production industry recommended the less pure material, Prime Western.—**Reported by C. Briarcliffe for Quebec.**

Alloys for Die Casting Are Discussed at Muncie

Speaker: D. L. Colwell

Apex Smelting Co.

Donald L. Colwell, director of laboratories, Apex Smelting Co., addressed the **Muncie Chapter** recently on "Aluminum and Zinc Alloys in the Die Casting Process".

Mr. Colwell's talk stressed the fact that there is considerable confusion and overlapping in the various types of alloy formulations used, much of which are needless. After reviewing the factors bearing on the various desirable physical characteristics, he discussed a few selected types which seemed to fit the usual demand. In these he included a high-silicon type for thin-walled castings, and high-zinc types for machinability, casting quality and price considerations.

Mention was made of the possibiilties in producing castings suitable for anodizing. He pointed out that, especially in the field of automotive decoration, trim, moldings, door handles and the like, there is a large potential market, which has scarcely been touched, for aluminum castings, which could, by eliminating the need for nickel-chromium plating, produce a more durable and less expensive product.—**Reported by R. R. Myers for Muncie.**

Speaks on Salt Bath Tool Hardening

Leaders at a Meeting of Worcester Chapter Included, From Left: Ralph Anderson, Pratt & Whitney Co.; Arthur L. Stowe, Massachusetts Steel Treating Corp., Technical Chairman; W. Ernest Bancroft, Pratt & Whitney Co., Who Spoke on "Salt Bath Tool Hardening"; and Lincoln G. Shaw, of Pratt & Inman, Chapter Chairman. (Photograph by C. Weston Russell)

Philadelphia Juniors Enjoy Barn Dance

The Floor Shook and the Rafters Quaked During the Barn Dance Social Which Was Recently Held by the Junior Section of the Philadelphia Chapter

National Officers Golden Gate Guests

National President Donald S. Clark Presented a Talk on "Propagation of Plastic Strain in Metals" and National Secretary W. H. Eisenman Gave a Review of the Activities and Aims of the A.S.M. at the National Officers Night Meeting Held Recently by the Golden Gate Chapter. Shown at the speakers' table are, from left: Bob Ray, program chairman; Dr. Clark; Mr. Eisenman; and William C. Matheson, chairman. (Reported by E. R. Babylon)

Gives History of Aluminum Development at Vancouver

Speaker: G. M. Young

Aluminum Co. of Canada

G. M. Young, technical director, Aluminum Co. of Canada, and vice-president A.S.M., spoke on the "History of Aluminum Alloy Development" at a meeting of the **Vancouver Island Chapter.**

Mr. Young traced the historical development of aluminum from 1825 on, covering its "chemical" period when it was almost a curiosity, its subsequent use in jewelry, and its eventual early industrial uses.

Total production in 1859 was 2 tons and its price was $17 per lb. In 1956 production was 3½ million tons and its price 22c per lb.

The larger part of Mr. Young's talk dealt with the effect of alloying elements on the physical, corrosion and casting properties of the resultant alloy. Effects of iron, manganese and nickel in improving high-temperature properties were pointed out. The early use of considerable percentages of zinc as a strengthener and its associated problems, such as hot shortness and intercrystalline corrosion, were also noted.

A particularly interesting point in Mr. Young's discussion covered the evolution of the copper alloys, beginning with Wilm's discovery that a 4½% copper, ½% magnesium and ½% manganese alloy would age harden at room temperature following a rapid cool. This was the initial Duralumin and it led to an increasing use of aluminum in structural and aircraft applications. Not only that, but the study of the mechanism of age hardening led to the discoveries of similar behavior in other metals and the development of special alloys. This was followed by artificial aging based on magnesium silicide.

The family of aluminum-silicon alloys was developed because of their excellent properties such as fluidity and freedom from hot shortness. They also resist corrosion and the 12% silicon alloy has physical properties which are a good compromise between high strength-low ductility and low strength-high ductility at 26,000 psi., and 12% elongation when modified.

The aluminum-magnesium family of alloys is coming into increasing prominence because of the ability of these alloys, such as Alcan B54S, to be welded and provide almost 100% strength of the plate in the weld. The shipbuilding and railroad industries are especially interested in these alloys which originated with the 2½% magnesium, ½% manganese British alloy, Birmabright.

Following the formal talk, Mr. Young answered a wide variety of questions concerning the use and properties of aluminum alloys.

How Emergency Metallurgy Is Applied in Peace-Time Explained at Baltimore

Speaker: A. O. Schaefer

Pencoyd Steel & Forge Corp.

A. O. Schaefer, past president A.S.M., and president, Pencoyd Steel & Forge Corp., spoke at the **Baltimore Chapter's** National Officers Night meeting on the "Application of Emergency Metallurgy to Peace-Time Work".

Ultrasonic testing of large forgings has proved to be a most valuable method of inspection. When jet engine forgings which had failed were examined to determine cause of failure, it was found that internal bursts were present. X-rays are used to locate this type of defect, but some bursts are flat and are not apparent in radiographs. This was proven by running some rotors to rupture speed after X-ray. They failed before reaching the expected tensile strength because of flat bursts. This problem was licked by ultrasonic inspection.

The sensitivity of ultrasonics presented a new problem because all indications shown on the oscilloscope may not be defects which would affect the service life of the part. Thus, techniques for the interpretation of indications observed on the oscilloscope had to be developed.

Flake formation in alloy steels for ordnance applications caused a high percentage of rejections. It was determined that the flakes occurred less frequently when intermediate heat treatment was applied between forging operations.

Troiano's theory on flake formation indicates that (a) hydrogen is essential, (b) transformation stresses are essential, (c) greatest danger is in mixed structures, (d) there is no correlation in mixed structures between the tendency for flakes and the average hydrogen content, (e) flakes in martensite are predominantly radial, and (f) flakes are never found in steels where transformation is above the MS line.

When the theory of hydrogen in steels was first advanced, it was difficult to analyze for the hydrogen content.

Stress relieving at low temperature of core specimens that were removed from certain alloy steel forgings eliminated hydrogen and improved elongation. The Germans removed hydrogen by vacuum pouring and this technique has been applied to large ingots. Gun barrels are tested for tempered martensite by the Charpy impact test at low temperatures. Metallurgical techniques developed during war periods have proven to be essential to industry in peace time.—**Reported by G. M. Hinton for Baltimore Chapter.**

Calumet Completes Educational Series

The Calumet Chapter Has Recently Completed a Series of Four Educational Lectures on the Subject, "Strength of Materials for Practical Application". The lecture series, which drew about 60 registrants, was presented by Gustav Florin, assistant professor of civil engineering, Purdue University. Shown at right is Tom Foss, vice-chairman of the chapter

Dr. Clark Is Guest in Detroit

National President Donald S. Clark, California Institute of Technology, Presented a Talk on the "Dynamic Properties of Metals" at the National Officers Night Meeting Held by the Detroit Chapter. Since this report has been given before many A.S.M. chapters during the past season, it will not be reported here. Dr. Clark is shown delivering the address

Penn State Students Visit Rem-Cru

W. E. Gregg (Right), Vice-President and Assistant General Manager of Rem-Cru Titanium, Inc., Welcomes B. Wagner (Left), B. F. Oliver (Center), and a Group of Faculty Members and Engineering Students From Penn State University During a Recent Visit. The visitors, all connected with Penn State's metallurgical department, talked with company executives and inspected company facilities to get first-hand knowledge of current developments in the titanium industry. (Photo by Don Parker)

Describes Powder Metallurgy Methods

Shown at a Meeting Held in Rochester Are, From Left: George Stern, Vice-President and Technical Director, American Sinteel Corp., Who Spoke on the "Latest Developments in High-Strength Structural Materials by Means of Powder Metallurgy"; Richard F. Eisenberg, University of Rochester; and Norman J. Finsterwalder, chairman of the Rochester Chapter

Speaker: George Stern
American Sinteel Corp.

At the **Rochester Chapter's** Sustaining Members and Educational Awards Night, representatives from most of the 23 sustaining member companies were present, and 107 persons received certificates for meeting the requirements of the educational course in Applied Metallurgy I, the second course of a three year program. Last year, the Nature of Metals was given and next year Applied Metallurgy II will be offered.

This year's educational program was designed to enhance the background of those already in metallurgical work and to provide fundamentals to those who seek a general understanding of metallurgy. It was of value to those who process, inspect, design or specify metals and alloys. The 13-week series was presented by J. J. Hoffer, metallurgist, A & O Division, Eastman Kodak Co.

George Stern, vice-president and technical director of American Sinteel Corp., presented a talk on the "Latest Developments in High-Strength Structural Materials by Means of Powder Metallurgy".

Mr. Stern reviewed the three basic considerations in any powder metallurgy work.

(1) Powder: The cleanliness and particle size of the powder is of primary concern. The particles should not all be the same size, the optimum range being 100 to 325 mesh.

(2) Dies: The dies are made of either toolsteel or carbide. The design of the dies is left to the tool designer who plays a very important role in making good powder metallurgy parts. The presses may be either mechanical or hydraulic and are usually of the double-action type.

(3) Sintering: The temperature and atmosphere are both important considerations. The temperature for iron parts was formerly around 2000° F., but some parts are now sintered up to 2400 or 2500° F. The controlled atmosphere is cracked ammonia, dry hydrogen or city gas.

High-strength structural materials made by powder metallurgy are becoming more important. The fact that 31,000 tons of iron powder was used for powder metallurgy in the last year attest to this fact. The tensile strength of these parts is many times in excess of 50,000 psi. These parts are made by either a single sintering operation at about 2100° F., or a double sintering operation which employs a low-temperature sintering, repressing, and high-temperature sintering.

One interesting example of high-strength parts is compressor blades made for gas turbine engines. These blades use an iron-copper alloy with 20% copper. The parts have 125,000 psi. tensile strength and 8% elongation. The blades are sintered in cracked ammonia, coined, infiltrated, pressed for straightening, then solution heat treated at 1650° F., restraightened and precipitation hardened at 932° F. The parts are then ready for final polishing and plating.

Another new development is the hot pressing operation. The process is used for making parts of borides and silicides and carbides. The parts are heated during pressing by either high-frequency induction or by resistance heating. Vacuum sintering is also widely used for making parts of titanium, tantalum or carbides of the refractory metals. Both processes produce parts that are much stronger than those produced by hydrogen sintering.

Mr. Stern, in summarizing the subject, stated that powder metallurgy parts should not be considered as a substitute for conventional metallurgy, but as a separate class of material designed specially for today's broadening applications.—**Reported by R. E. Avery for Rochester.**

Clark Receives Plaque at Vancouver

A.S.M. President Donald S. Clark Spoke at a Meeting Held by the Vancouver Island Chapter on the "Dynamic Properties of Metals", and Presented a Brief Resume of Activities at Headquarters. He is shown, left, receiving a plaque presented on behalf of the chapter from R. D. Barer, chairman

South Dakota Students at Rocky Mountain

Metallurgy Students From the South Dakota School of Mines and Technology, on an Industrial Tour in Colorado, Stopped in Denver to Attend a Meeting of the Rocky Mountain Chapter. Present were, from left, seated: Donald Orts, student; Paul H. Anderson, department of metallurgy, South Dakota School of Mines and Technology, who conducted the tour; F. L. LaQue, International Nickel Co. Inc., who spoke on "Operations Sea Horse"; Frank W. Soper, chapter chairman; and Dennis Malwitz, student. Standing, from left: Peter Koskinen, Curtis Westley, Roland Wagner, Harrold Swarm, Andre Zoutte, Dean Orr, Gerald Swenson, W. Miller, W. Nissen, Mohinder Gupta, Robert Hays, Wayne Burk, and Robert Banning, students

Speaker: F. L. LaQue

International Nickel Co. Inc.

F. L. LaQue, vice-president and manager of development and research, International Nickel Co. Inc., presented a talk entitled "Operations Sea Horse" at a meeting of the **Rocky Mountain Chapter** in Denver. Paul H. Anderson, head of the department of metallurgy, South Dakota School of Mines and Technology, and a group of 15 students were special guests at this meeting.

The speaker gave a brief history of the establishment and growth of International Nickel's corrosion testing stations at Kure Beach and Harbor Island, N.C., and he pointed out that their original purpose was the testing of a mere half-dozen specimens in sea water and sea atmosphere. He observed that in the accumulation and preparation of these specimens other interested companies and materials were forthcoming until, in 1935, some 5000 specimens were involved rather than the original "mere half dozen". Today there are some 36,000 specimens, including not only metals but such items as cordage, plastic, timber preservatives, etc., exposed to atmosphere tests, with many thousands more being tested in a variety of ways involving sea water.

A movie was shown of the facilities, some of the testing equipment, and materials undergoing study. It was pointed out that the tests at one time had consisted of simply exposing specimens to sea water or atmosphere. Now tests may involve model or even full-scale replicas of heat exchangers, stills, water systems, etc., in addition to exposure under a variety of controlled conditions. The original interest in loss of weight and change of appearance has grown to include tests involving galvanic action, velocity effect, marine growths and parasites, and other conditions affecting materials in marine environments.

Mr. LaQue, in his opening remarks, had questioned the probability of much interest in sea water corrosion problems, since Rocky Mountain Chapter is definitely not in proximity to the ocean. However, very good attendance and a lively question and answer session at the meeting's close indicated both interest and appreciation for an excellent talk.

Dr. Anderson and the 15 student guests had visited seven metallurgical plants in Colorado during the week of Mar. 10-16, including Climax Molybdenum Co., Arkansas Valley Smelter of the American Smelting and Refining Co., Carlton Mill of the Golden Cycle Corp., Pueblo Plant of the Colorado Fuel and Iron Corp., the Triplex Corp., and the Globe Smelter of the American Smelting and Refining Co.

The department of metallurgy at the South Dakota School of Mines in Rapid City is somewhat isolated from the group activities of A.S.M. One of the annual events, however, is the 400-mile drive down to Denver to attend a regular meeting of the nearest chapter. For the past two years, Dr. Anderson has brought a carload of students along with him, but this year, with the annual inspection trip coinciding with the meeting date, he was able to introduce a record number of 15 of his students to the A.S.M. membership.—**Reported by V. D. Heinze for Rocky Mountain.**

Continuous Casting Talk And Film Featured at Toledo

Speaker: Rufus Easton

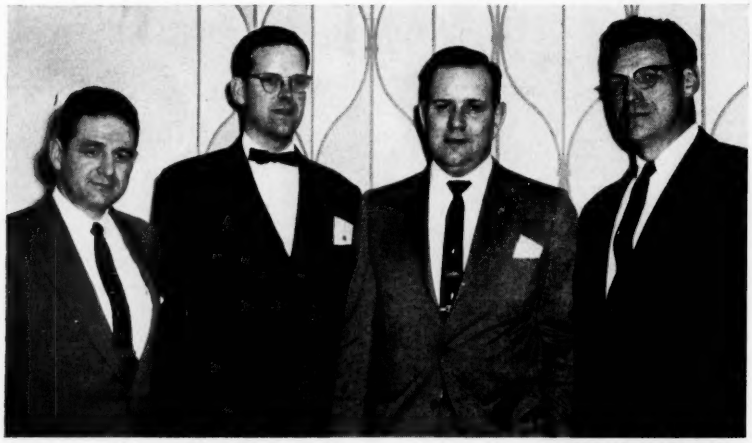
Koppers Co., Inc.

Rufus Easton, manager, continuous casting section, Koppers Co., Inc., presented a talk on "Continuous Casting" at a meeting held by the **Toledo Chapter.**

After brief introductory remarks defining and describing continuous casting as applied to both ferrous and nonferrous metals by Mr. Easton, a motion picture "Continuous Casting of Steel at the Plant of Atlas Steels Ltd." was presented, in which production of stainless steel slabs directly from molten metal was shown.

At the conclusion of the picture, there was considerable discussion, first of the mechanics of the process as shown in the picture, and later of the metallurgical and economic comparisons of continuous casting with conventional processing methods.—**Reported by R. E. Hanslip for Toledo Chapter.**

Presents Talk on Forgings at Buffalo



Paul F. Adams, Metallurgist, Wyman-Gordon Co., Presented a Talk on "Forgings" at a Meeting Held by Buffalo Chapter. Shown are, from left: Joseph Engle, Republic Steel Corp.; Mathew Hayes, chapter chairman; Mr. Adams; and Charles W. Hart, vice-chairman and program chairman

Speaker: P. F. Adams

Wyman-Gordon Co.

End product forging quality can be influenced by design. For this reason P. F. Adams, metallurgist, Wyman-Gordon Co., during his discussion on "Forgings" at a meeting held by the **Buffalo Chapter,** emphasized the advisability of the design engineer working closely with the forge shop during the design stage of the part.

Mr. Adams indicated that certain properties existing in forgings are unique to the forging process and may not be found in other wrought forms of materials. A forging vendor who is constantly working with forgings of various geometrical shapes produced in various alloys can recognize these more readily than a general design engineer. For this reason the general design engineer should feel free to call upon the forging expert at the time of the inception of the forging drawing. Such consultation can often eliminate later problems associated with properties or the ability to produce.

The question has often been asked why 35,000 and 50,000-ton presses were installed at Wyman-Gordon when a large number of the forgings produced were of a size that could be made on the 18,000-ton press. In answer to this question, Mr. Adams indicated that the size alone was not the reason for larger presses. A much greater emphasis than ever before is being placed on tolerances and consequently, even with equal sizes, much greater forging pressures are required. It was also pointed out that in earlier presses, deflection could under certain circumstances present problems. In some cases it was observed that even though the die blocks were pressed shut around the periphery, deflection would result in a gap of 0.100 to 0.200 in. at the center of the impression. For this reason attention was given in the design of the newer presses to minimizing this possibility. The side cylinders available on some of these presses also make possible the use of split dies of various types which can eliminate or drastically reduce the draft required for part withdrawal on some types of forgings. Both the 35,000 and 50,000-ton presses are capable of accepting dies 22 in. long by 12 in. wide; however, the largest used to date have been 13 in. by 5 in. Even though the 18,000-ton press could utilize dies almost of this size (13 in. x 5 in.), the use of the heavier presses has permitted forging to closer end product tolerances, made possible more complicated shapes, has permitted the ratio of rib height to thickness to be increased, and, in general, has permitted metal to be flowed in a more desirable pattern than would have been possible with the older equipment.

Early in the large press program doubt was expressed by many people whether the suppliers of die blocks would be able to manufacture blocks sufficiently large to use the ultimate available platen area of these presses. Mr. Adams indicated that insofar as sizes required to date are concerned, there has been no significant trouble in die block quality or procurement.

He also indicated that good results have been obtained in producing quality forgings from vacuum melted alloys. It was his opinion that vacuum melting of certain alloys amenable to the process had resulted in improved over-all quality of the end product forgings.—**Reported by George F. Kappelt for Buffalo Chapter.**

Compliments

To JOHN P. HIRTH, student at Carnegie Tech, on being awarded a Fulbright Scholarship to study metallurgy at the University of Bristol, England.

♦ ♦ ♦

To J. BLAND, Engineering Research Department, Standard Oil Co. (Ind.), on being selected as the recipient of the James F. Lincoln Gold Metal for 1956, awarded for "the greatest original contribution to the advancement and use of welding as published in an issue of the *Welding Journal* during the past 12-month period". Mr. Bland's paper was on the "Arc Welding of 2.25% Chromium-1.0% Molybdenum Alloy Steel Pipe". He is a member of Chicago Chapter A.S.M.

♦ ♦ ♦

To the following A.S.M. members who have recently been awarded honors or medals by the American Foundrymen's Society: HARRY W. DIETERT, chairman of the board, Harry W. Dietert Co., on his election to president A.F.S.; to KARL L. LANDGREBE, Jr., vice-president, foundry operations, The Wheland Co., on being elected a national director for a three-year period; to ARTHUR E. SCHUH, director of research and development, United States Pipe and Foundry Co., on being chosen to receive an A.F.S. Award of Scientific Merit; to H. A. DEANE, vice-president, Campbell, Wyant and Cannon Foundry Co., who received a Service Citation Award; to CHARLES C. DONOHO, chief metallurgist, American Cast Iron Pipe Co., who received the Peter L. Simpson Gold Medal for "outstanding contributions to the ferrous castings industry, especially in the fields of gray iron, nodular iron and steel"; and to HYMAN BORNSTEIN, on being chosen as the Hoyt Memorial Lecturer. He presented a talk on "Progress in Iron Castings".

Clark Guest at Puget Sound

A.S.M. National President D. S. Clark, California Institute of Technology, was a guest of the **Puget Sound Chapter** during its Sustaining Members Night meeting. Dr. Clark commented on the importance of the sustaining members to the Society and presented recognition certificates to the many representatives who attended the meeting.

Dr. Clark went on to discuss the purpose of the Metals Engineering Institute, and made some comments about the Western Metal Show which was in the formation stage at the time of his talk. He reviewed the new procedure which is to govern the publication of preprints and discussed various other phases of national headquarters news and activities.

Dr. Clark's technical lecture was entitled "Dynamic Properties of Metals".—**Reported by Clement Walker for Puget Sound.**

Educational Report —Ontario Chapter

During the last several years, the **Ontario Chapter** has undertaken an extensive program of metallurgical education for engineers, technicians and laymen. Rather than discuss past programs, it is perhaps best to use the current year as an example to show the Chapter's educational activity.

Fall Course in Toronto

During the 1956 fall session, the Chapter, in conjunction with the Department of Extension, University of Toronto, sponsored a ten-lecture series on the "Heat Treatment of Metals." This course was presented by W. C. Winegard of the department of metallurgy, University of Toronto, and was intended to be fundamental in nature rather than practical. The first five lectures were on the nonferrous alloys and covered such subjects as crystallography, structure of pure metals and alloys, solidification, nucleation and growth, equilibrium diagrams, solid phase changes, solution treating, age hardening and precipitation hardening. Both the aluminum and copper alloys were discussed with reference to practical heat treatment.

The last five lectures described the ferrous alloys. Martensite, bainite and pearlite reactions were discussed in detail. Other topics covered were time - temperature - transformation curves, alloy additions, hardenability, temperability, tool and stainless steels. Thirty-five engineers and technicians attended that series.

Spring Course in St. Catharines

The same lecture series was presented to 60 engineers and technicians in St. Cartharines at the Collegiate and Vocational School, again sponsored by Ontario Chapter, with Thompson Products acting as the Society representatives in that area. Lecturers were G. B. Craig and W. C. Winegard, professors at the University of Toronto.

University Open House

During this current session, the Society took a very forward and dramatic step to help alleviate the critical shortage of metallurgical engineers. The Council of the Ontario Chapter was of one opinion as to the probable cause of the small number of students entering metallurgy courses in the university. It was felt that few students and fewer teachers were aware of the true nature of metallurgical work today.

The Chapter decided to sponsor a dinner and Open House for Ontario science and guidance teachers, and 600 invitations were extended. Two hundred teachers accepted the invitation to dinner at the Prince George Hotel in February to hear John Convey, one of the principal speakers, outline the major problems facing the metallurgist in the high-temperature field, in low-temperature operations, and in the atomic energy field. Lloyd Pidgeon discussed the current trends in metallurgical education, and suggested that the metallurgist was both a high-temperature chemist and a solid-state physicist.

After dinner, the teachers were taken to the department of metallurgy at the University of Toronto, where 35 prominent metallurgists escorted them through the laboratories. Both undergraduate experiments and graduate research were shown to the visitors to give them a complete picture of metallurgy and metallurgical education.

This evening was unique in that a technical society, in conjunction with the University, actually took a concrete step forward to help eliminate the shortage of engineers.

Scholarships

The American Society for Metals offers scholarships to every university with a recognized metallurgy course. For example, the top student in first year metallurgy at Toronto, Queens and McMaster receives a $400 scholarship from the A.S.M. In addition to this, the Ontario Chapter gives a $100 prize for the best thesis in metallurgy at the University of Toronto, Queens University and Ryerson Institute of Technology. It is expected that McMaster University will also be offered an A.S.M. prize for thesis work in metallurgy.

It is anticipated that the Chapter will continue to present educational lectures in Toronto, St. Catharines and Hamilton. It is also likely that the Chapter will remain in the forefront in the attempt to interest young men in metallurgical engineering.—**Reported by W. C. Winegard, for the Education Committee.**

Narrates Story of Corrosion in Action

R. J. Rice (Right), International Nickel Co. Inc., Narrated the Story Shown by the Movie "Corrosion in Action" Which Was Presented at a Meeting of North Texas Chapter. Pictured with Mr. Rice is J. P. Fowler

Speaker: R. J. Rice

International Nickel Co. Inc.

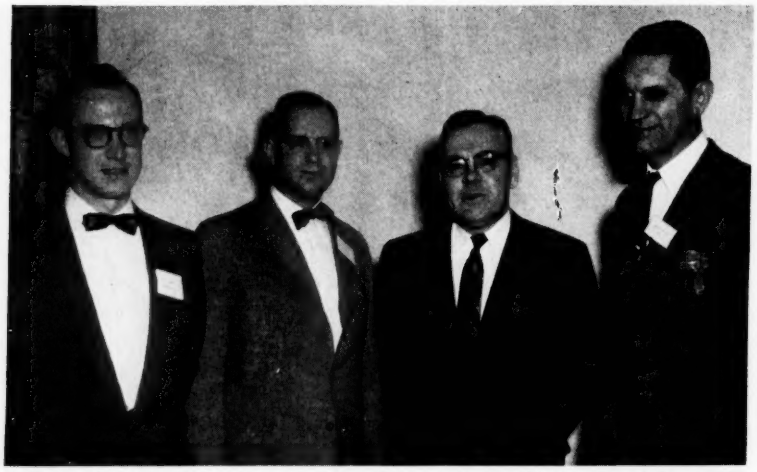
A movie, "Corrosion In Action", was presented at a meeting of the **North Texas Chapter** with R. J. Rice, International Nickel Co. Inc., as moderator. This film was in a series of three parts, the first of which gave examples showing the economic importance of corrosion. This was followed by the history and development of the electrochemical theory of corrosion. The role of oxygen as a promoter of cathodic reactions was described in detail.

The second part was a discussion of galvanic action as related to the electromotive series. By immersion of specimens in gels which contained color-changing reagents, the existence of anodic and cathodic corrosion products was observed.

Prevention of corrosion by protective films or passivation of iron was illustrated in the third part. The potential relationship of iron and stainless steels in their active and passive states was described. Progress that has been made in producing more "corrosion resistant" alloys was briefly discussed.

A great interest was shown by the attending members and guests in the pictorial comparisons of the progress of rusting of different types of steels. Several steps that may be taken to avoid corrosion were outlined. Many advantages that may be derived from a scientific approach to the solution of corrosion problems were illustrated by appropriate examples.—**Reported by S. Maszy for North Texas Chapter.**

Speaks on Sleeve Bearing Principles



"Sleeve Bearings" Was the Subject Discussed by Edwin Crankshaw, The Cleveland Graphite Bronze Division of Clevite Corp., at a Meeting Held by Northwestern Pennsylvania Chapter. Shown during the meeting are, from left: Joseph D. Barnes, publicity committee; G. D. Kimpel, chairman; Mr. Crankshaw; and L. R. Maitland, technical chairman of the meeting

Speaker: Edwin Crankshaw
Cleveland Graphite Bronze

Edwin Crankshaw, chief engineer, The Cleveland Graphite Bronze Division, Clevite Corp., gave a lecture before the **Northwestern Pennsylvania Chapter** on "Sleeve Bearing Principles".

In view of the increase in automotive engine horsepower from 130 a few years ago to 300 today and an expected 350 in the near future, Mr. Crankshaw pointed out that sleeve bearing requirements in these engines have increased proportionately.

In stating the requirements of a bearing material he mentioned the fact that metal-to-metal contact is encountered and therefore a bearing's rubbing ability must be considered. Also, a bearing must be able to conform to the housing and shaft, and, further, it must be able to "swallow dirt", hence, imbeddability of the material is another important factor.

Fatigue life of the bearing material is very important as loads on bearings have increased from 2000 psi. 15 years ago to 5500 psi. at the present time.

Corrosion of materials is not as big a factor as it was a few years ago since the quality of lubricants now available has practically eliminated corrosion.

The design of sleeve bearings for internal combustion engines has been improved considerably by the studies, tests and calculations that have been made in the past few years. These include studies and tests on engine loads, temperatures, oil film thickness, tolerances, finishes and hardness of materials. Mr. Crankshaw showed slides illustrating how to combine the three engine loads—explosion pressure, reciprocating force, and rotating inertia force —into a vectorial diagram in order to calculate bearing stresses at several speeds. From this diagram, a rod load versus engine speed curve is plotted as well as a crank load versus engine speed curve.

In discussing finishes and hardness of shafts, Mr. Crankshaw mentioned that shaft hardness is tied in with bearing performance and that the harder the shaft, the better the performance.

Brinell 170 to 270 is usually adequate for tin or lead-base babbitt bearings while Brinell 270 to 550 is required for copper lead-base tri-metal bearings. Aluminum bearings perform best with a shaft hardness of Rockwell 60.

Shaft finishes, for good bearing performance, should be a maximum of 20 micro in. The method of obtaining this finish is important, best results being obtained if the shaft is (a) machine turned in the direction it will operate in service, (b) ground in the opposite direction, and (c) lapped in the direction in which it will run.

Grooves in the bearing for oil lubrication are best if kept simple to allow oil to get into the bearing and back to the sump.

Materials for sleeve bearings are many and varied. The best material for the job is usually a compromise for the several factors considered.

Several slides were shown of various materials versus bearing life and loads, Mr. Crankshaw pointing out that the tri-metal silver bearings are capable of withstanding loads up to 7500 psi. Photomicrographs of several bearings revealed interesting dendritic and cellular structures.—**Reported by Joseph D. Barnes for Northwestern Pennsylvania.**

Defines Bonded Assemblies in Montreal

Jack Waller, Chief Materials and Process Engineer, Canadair Ltd., and Immediate Past Chairman, Montreal Chapter, Gave a Talk on the "Metal Bonding of Aircraft Assemblies" at a Meeting in Montreal. He defined metal bonding as the process of joining together metal parts to form an assembly, using a resin-type adhesive. The joints so formed have very high strengths which are also consistent and reliable. He also explained how his company was able to produce bonded assemblies of specification quality. Shown are, from left: Arnold Boehm, chairman; Mr. Waller; and K. W. Shaw, vice-chairman. (Reported by G. F. Norman)

A.S.M. Represented on Documentation Symposium

Documentation activities of the American Society for Metals were well represented at the Symposium on Systems for Information Retrieval held in Cleveland Apr. 15 through 17, 1957. The symposium was presented by Western Reserve University in cooperation with the Council on Documentation Research and a number of co-sponsoring agencies including the A.S.M.

Three of the papers presented during the meeting were based on A.S.M. projects and activities as follows:

"An Edge-Notched Punched-Card System for Metallurgy", by Marjorie R. Hyslop, managing editor, *Metal Progress.*

"Adaptation of the ASM-SLA Metallurgical Literature Codes for Use With Machine-Sorted Punched Cards", by Barbara H. Weil and E. A. Clapp, Electro Metallurgical Co.

"Abstracting, Coding and Searching the Metallurgical Literature for A.S.M.—the W.R.U. Searching Selector", by Cedric Flagg and Allen Kent, Center for Documentation and Communication Research, Western Reserve University.

The symposium was supplemented by an exhibit area where equipment necessary to demonstrate the various systems described in the symposium papers was on display. Space was provided in this exhibit area for demonstration of the ASM-SLA punched card system and for discussion of metallurgical documentation problems. Registered attendance at the symposium was 870.

Talks on Properties of Ceramics

Joseph E. Burke, General Electric Co., Discussed "Mechanical Behavior of Ceramics" at a Joint Meeting of the Chicago-Western Chapter and the Local Chapter of the American Society of Tool Engineers. Shown are, from left: C. S. Barrett, University of Chicago, technical chairman; Mr. Burke; and A. F. Koctur, General Motors Corp., chapter chairman

Speaker: J. E. Burke

General Electric Co.

Members of the **Chicago-Western Chapter** heard a talk on the "Mechanical Behavior of Ceramics" at a meeting held jointly with the Fox River Valley Chapter of the American Society of Tool Engineers. The speaker was Joseph E. Burke, manager of ceramic studies, General Electric Research Laboratory.

Mr. Burke brought out the fact that considerable progress has been made in the development of ceramic materials and in the understanding of their mechanical properties, composition, temperature, grain size, porosity and microstructure.

He then discussed the strength of ceramics at high temperature, their electrical properties and use as insulators, magnetic properties and use in high-frequency transformers and electronic computers, chemical properties and resistance to corrosion. He also pointed out some of the applications they have in the atomic energy field.

One of the characteristics of ceramics is that their physical properties, particularly strength, remain fairly constant as temperature increases until plastic flow begins. Ceramic materials have been considered to be a brittle material, although some recent work has indicated the possibility that some ceramics may possess a certain amount of ductility. The ductility in aluminum oxide at elevated temperatures was illustrated by a short movie.

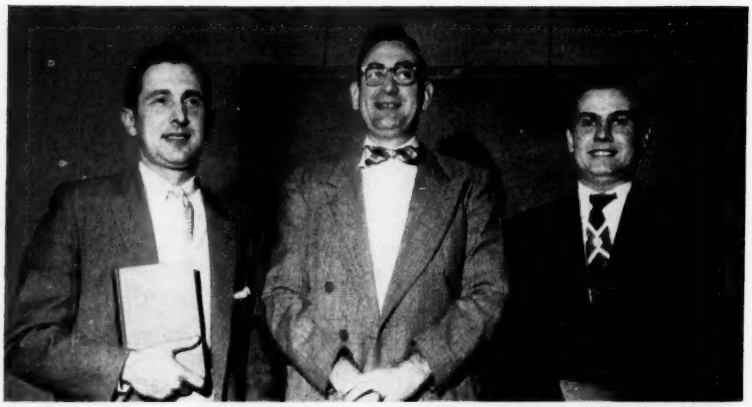
The control of structure was discussed from the standpoint of the effect of temperature, particle size and addition of a second phase.

Recently developed ceramic cutting tools were discussed, and it was pointed out that at the present time these cutting tools are used as finishing tools. They are adaptable for light cuts made at high speeds where the tool is operating at a fairly high temperature. — **Reported by M. F. Surls for Chicago-Western Chapter.**

Clark on Trial at Texas Meeting

Shown at the Western Night Meeting Held by the Texas Chapter Are, From Left: "Lily Langtry", Impersonated by Gene Suhm; "Judge Roy Bean", Who Is Wes Kuenemann; Bailiff Mack Crook; Sheriff Ken Ward; and Defendant, Donald S. Clark, National President A.S.M. Dr. Clark presented a talk on "Dynamic Properties of Metals". (Photograph by Lee Dolan for Texas)

Toolsteels Subject at Junior's Meeting



Edward Fleming, Crucible Steel Co. of America, Spoke on "Toolsteels" at a Meeting of the Junior Section of the Philadelphia Chapter. Door prizes awarded to members, above, from left, Fred Klein, Willard L. Hunsberger and James H. Black, were copies of the A.S.M. book "Toolsteels". William M. Reilly, Jr., not pictured, was also a recipient of the handbook

Speaker: Edward Fleming

Crucible Steel Co. of America

Edward Fleming, sales manager, Crucible Steel Co. of America, and the first chairman of the Chapter (1952-1953), presented a talk on "Toolsteels" at the Past Chairmen's Night Meeting of the **Junior Section of the Philadelphia Chapter.**

The initial points of Mr. Fleming's discussion on toolsteel were the proper selection and the desirable qualities to be sought in this material. It was noted that the intended use of the toolsteel is important in the proper selection of material with one or more of the following qualities to secure optimum service and life: hardness, toughness, resistance to abrasion, and resistance to heat.

Mr. Fleming touched briefly on the effects of alloying elements in toolsteel and covered the list of alloying elements alphabetically from carbon to tungsten, discussing the range of alloying elements normally used and what properties each element or combination of elements would impart to the toolsteel.

The six types of toolsteels and their uses discussed by the speaker were water hardening, oil hardening, air hardening, shock resistant, hot working, and high-speed. In conclusion, Mr. Fleming cited some examples of development work being done in this field on sulphurized and on vacuum-melted toolsteels. He stated that vacuum melting has produced very clean steels, with its chief attribute being improvement of fatigue life.

A lively question and answer period followed, and through this informal discussion it became apparent that each user of toolsteel has his own idea as to the type and grade which should be used.

As an added point of interest, handbooks entitled, "Tool Steel" were awarded as door prizes. Recipients were Fred Klein, William Reilly, James H. Black and Willard L. Hunsberger.

Note From a Metallurgist

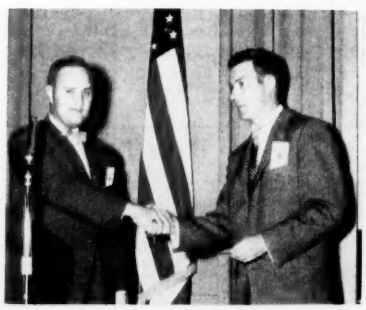
The following letter was received recently and is printed in full with the hope that the suggestion contained will bear fruit.

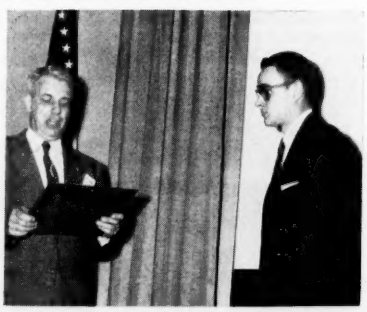
"The metallurgical departments in the colleges throughout the country are concerned with the problem of interesting more students to enter the field of metallurgical engineering. I know that you are well aware of the critical shortage of metallurgical engineers and that the American Society for Metals has done a number of things to call the high school student's attention to the opportunities available in metallurgical work.

"I am wondering whether or not the availability of copies of *Metal Progress* in various high schools would aid in pointing out the field of metallurgical engineering to the high-school student. This could be accomplished rather easily if the membership at large were aware of a program of this type and were to send their copies of *Metal Progress*, after they have served their purpose with the membership, to their local high-school library. I am about to undertake to send copies to our local high schools here in Ann Arbor. If you think this program has any merit, a note inserted in *Metals Review* or *Metal Progress* may aid in interesting more people in sending their *Metal Progress* to their local high schools."

C. A. Siebert /Signed/
Consulting Metallurgical Engineer
Ann Arbor, Mich.

Granted Awards in Cincinnati





Left: M. C. LaBau (Left), Chairman of the Cincinnati Chapter, Is Shown Presenting the A.S.M. Foundation Scholarship Award to Gerald Shawhan, Junior in the Department of Metallurgy, University of Cincinnati. (Right): William Koster, chairman of the educational and student affairs committee, is shown presenting the Chapter's Esslinger Award of $50 to William Jones, III, an award given annually to an outstanding metallurgy student at U. of C.

At a recent meeting of the **Cincinnati Chapter** the annual A.S.M. Foundation Scholarship and the Essingler Award were presented to outstanding students from the department of chemical and metallurgical engineering at the University of Cincinnati.

William Licht, head of the department, introduced Gerald Shawhan, a junior in the department of metallurgy, and recipient of the Foundation Scholarship of $400, who was presented with a scholarship certificate plaque by M. C. LaBau, chairman of the Cincinnati Chapter.

Dr. Licht also introduced William Jones, III, winner of the Esslinger Award. This award was presented by William Koster, chairman of the educational and student affairs committee. The $50 award is presented annually to the outstanding student in metallurgy at the University of Cincinnati, based on the judgment of the faculty of the metallurgical department.—**Reported by John H. Timmers for Cincinnati.**

Materials for Electric Power Transmission Topic At Golden Gate Meeting

Speaker: R. A. Schatzel

American Society for Testing Materials

The Golden Gate Chapter, in a joint meeting with the A.S.T.M., heard R. A. Schatzel, national president A.S.T.M. and vice-president, Rome Cable Corp., speak on "Materials for Electric Power Transmission".

Dr. Schatzel introduced his talk by pointing out that A.S.T.M. and the standardization movement have grown up together and declared that each industry must develop a set of standards. An immediate example is the nuclear energy industry.

He followed the progress in the development of electrical transmission cables from Edison's 120 d.c. underground cable (copper, jute, asphalt and pipe) to the 400,000-volt cables expected to be in use by 1960.

Furthering the need for greater use of transmission cables, he explained, is the accelerated rate of increase in the use of electricity for a multitude of applications. Automation, by increasing the output per worker, requires more electrical energy per worker. Because it is cheaper to transport electrical energy than the fuel to generate it, there is a movement toward the use of longer transmission lines. This, and the replacing of man power with electrical energy, has brought the consumption of copper by the wire industry to 58% of the nation's total usage.—**Reported by E. R. Babylon for Golden Gate.**

Describes Copper Alloys in Cincinnati

Raymond J. Severson, Assistant General Sales Manager, Ampco Metals, Inc., Spoke on "Copper Alloys for the Occasional Metallurgist" at a Meeting of the Cincinnati Chapter. Mr. Severson (right) is shown with M. C. LaBau

Speaker: Raymond J. Severson

Ampco Metals, Inc.

At a meeting held by the **Cincinnati Chapter,** Raymond J. Severson, assistant general sales manager, Ampco Metals, Inc., presented a comprehensive talk covering the full range of copper alloys, including brass, bronze and the new Superston-40 alloy, entitled "Copper Alloys for the Occasional Metallurgist".

The speaker covered the physical metallurgy of the commonly used alpha, alpha beta and beta brasses as well as aluminum, tin-lead and manganese bronzes. The wide range of physical properties of these copper alloys was discussed in detail with respect to the relative and distinguishing merits of each. Mr. Severson pointed out that with the new Superston-40 alloy, which is an aluminum bronze with 12% manganese, yield strengths of 75,000 psi. and tensile strengths of 125,000 psi., along with izod impact values of 25 ft-lb., are attainable in the heat treated condition.

It was shown that in selecting an alloy for a particular application, the alloy must meet all of the operational demands of the component. A static physical test alone is not necessarily sufficient since endurance limit and corrosion properties play an important role.

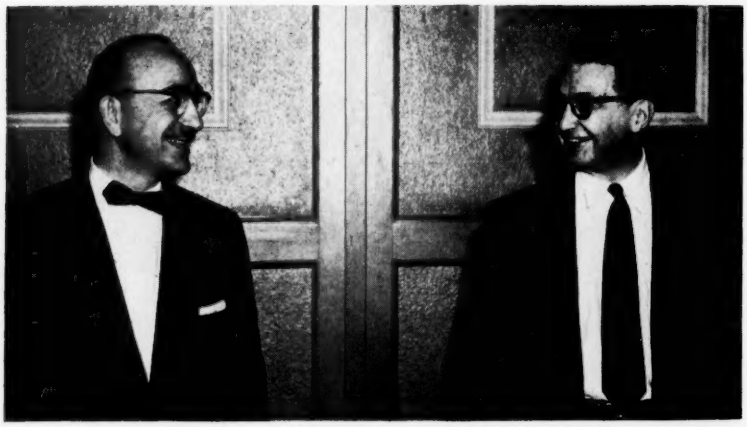
The speaker stated that since mass has considerable influence on the physical properties of some copper alloy castings, it is of paramount importance to select test specimens closely related to the thickness of the actual component. It was further stated that it is even more desirable to select test bars from the actual casting. The speaker emphasized that often considerable difference in physical properties is noted between test specimens taken from the castings and those cast as special test bars. He also pointed out that the properties of copper alloys are in keeping with the facts of life in that you do not gain anything without sacrificing something in return.

In closing the speaker mentioned that it was important to modern civilization that copper was discovered prior to the discovery of steel, otherwise man would never have been able to keep records thereon throughout the centuries, since the steel would have rusted.—**Reported by John H. Timmers for Cincinnati.**

Stanford Student Receives Scholarship

Jerry Morby, Metallurgy Student at Stanford University, Is Shown as He Was Presented an A.S.M. Scholarship by National Secretary William H. Eisenman During a Recently Held Meeting of the Golden Gate Chapter

Discusses Ultra-High Strength Steels



Peter Payson (Right), Crucible Steel Co. of America, Who Gave a Talk on "Ultra-High Strength Alloy Steels" at a Meeting of the Detroit Chapter, Is Shown With Robert Sergeson, Technical Chairman of the Meeting

Speaker: Peter Payson

Crucible Steel Co. of America

"Ultra-High Strength Alloy Steels" was the subject of a talk given before the **Detroit Chapter** by Peter Payson, assistant director of research, Crucible Steel Co. of America.

Steels having useful properties at 225,000 psi. or higher tensile strength level were defined as being of ultra-high strength. By useful is meant not brittle. Some of the newer steels are 54-56 Rockwell C in hardness and have over 300,000 psi. ultimate strength. In aircraft equivalent weight of steel has to be as strong as aluminum to be useful. The old minimum was 180,000 psi. New advances require greater strength. Ordinary steels lost their notch impact resistance when treated to much higher strength, having about 10 to 12 ft-lb. notch impact at 230,000 psi.

Low-carbon martensitic structure appeared the best means of achieving high tensile and good ductility. Fairly large alloy additions including high silicon were tried. Hy-Tuf was developed, containing the following: 0.25% C, 1.35% Mn, 1.50% Si, 1.80% Ni, 0.25% Cu, and 0.40% Mo. This grade developed 235,000 psi. with good ductility. Hy-Tuf also showed superior fatigue values for life to failure at 100,000 cycles or less, and at very low temperatures has higher endurance limit than 4340 treated to the same strength level.

For tensile values up to 200,000 psi., all steels have about the same notch tensile values. Above this value Hy-Tuf shows superior notch tensile values. Hy-Tuf does not become embrittled when tempered at 500° F.—embrittling does not occur in this steel until tempering exceeds 600° F.

Tempering at lower temperature for a long time duplicates higher temperature for a short time. Three stages of tempering occur. If more than 0.25% carbon is present, epsilon carbide separates at low temperature and impact value increases. At higher temperatures, when epsilon changes to conventional Fe_3C, embrittlement starts to take place. Silicon inhibits separation of Fe_3C. About 1% silicon by weight raises the temperature of Fe_3C formation to about 600° F. and also inhibits softening. Thus high-strength tough steel is possible.

Although Hy-Tuf was designed for aircraft landing gear, it has been used in large quantities for carbide-tipped bits for rock drilling.

Type-4340 tempered at 400° F. does give high strength and good toughness at 270,000 psi. and has been used by aircraft people for landing gears. For these high strength requirements the question was asked: "Was nickel necessary?" After many experimental melts were tested, two grades were developed:

Grade	C	Mn	Si	Ni	Cr	Mo	V
260	0.35%	1.4%	1.9%	0.09%	1.4%	0.25%	0.25%
290	0.42%	1.4%	1.9%	0.09%	1.4%	0.40%	0.25%

Both these grades resist tempering up to about 650° F. and therefore can be heat treated to very high strengths without loss of toughness.

Hydrogen embrittlement is associated with these high-strength steels when they are cadmium plated. High-silicon steels showed greater resistance to embrittlement than ordinary steels; however, if ordinary steels are baked properly, embrittlement will be eliminated.

Aircraft skin temperature becomes important at the very high speeds contemplated for future aircraft. Certain high-tempering temperature resisting steels containing 12% Cr, etc., have been developed. For even higher temperatures, hot work toolsteels have been used. A new steel shows strength of 250,000 psi. at 1000° F. A 400,000 psi. room temperature steel is the present goal, and 200,000 psi. at 1200° F.—**Reported by Jack LaBelle for Detroit.**

Talks in Hartford on Material Needs of the Automotive Gas Turbine

Speaker: R. F. Thomson

General Motors Corp.

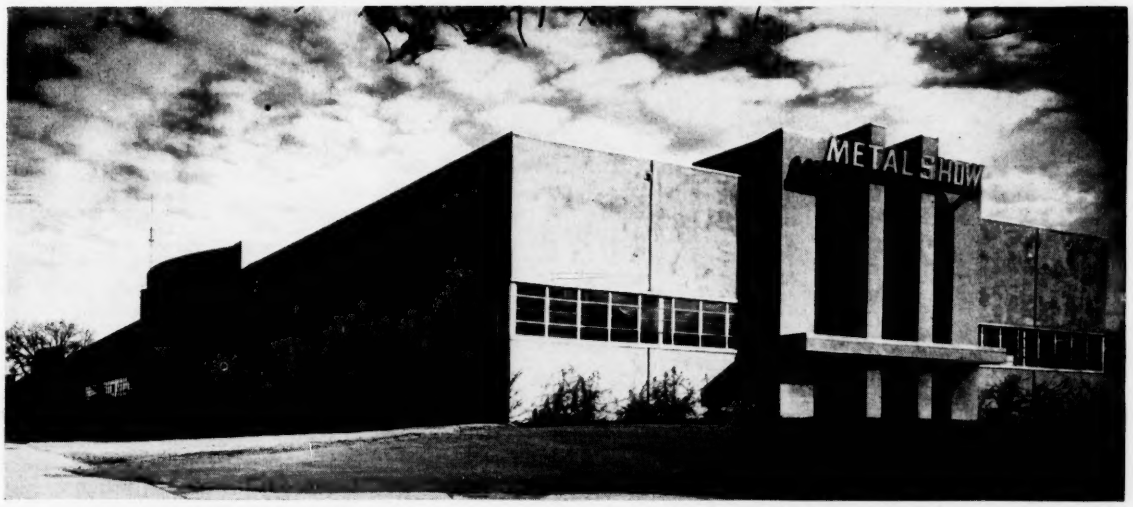
Robert F. Thomson, General Motors Research Center, spoke at a meeting of the **Hartford Chapter** on the "Automotive Gas Turbine and Its Metallurgical Needs".

Dr. Thomson explained the principles and operation of an automotive gas turbine and also an automotive free piston engine, using schematic diagrams and actual pictures to illustrate his talk. The gas turbine consists of a compressor wheel, driven by a first-stage turbine wheel, which supplies air to a combustion chamber into which fuel is injected and ignited. In the hot gas stream beyond the first turbine wheel is the second-stage turbine wheel, which is connected through a transmission to the drive shaft. In some designs part of the hot exhaust gas is used to preheat the combustion components for greater efficiency. The free piston engine has two horizontally opposed pistons operating in the same combustion chamber. After each injection of fuel and explosion the pistons are returned by air bounce chambers rather than by the usual link rods and crankshaft rotation. The hot exhaust gas at 600 to 800° F. is then expelled from the combustion chamber or cylinder through a series of turbine wheels which are connected to the drive shaft.

Dr. Thomson compared the materials used in these two engines with the reciprocating engine, which is made mostly from cast iron and carbon steel, with some aluminum and very little alloy or stainless steel. The gas turbine uses considerably more alloy and stainless steel and may require superalloy for the turbine blades. The free piston engines use the same materials as the reciprocating engine except that possibly more alloy steel is used in some of the hot sections.

A chart comparing the fuel consumption and type, weight per horsepower, volume per horsepower, etc., for various types of engines built and designed to date showed that the gas turbine and free piston engine might be competitive with present and potential reciprocating engines for specific applications. The gas turbine and free piston engine are trying to catch up with a moving target—the reciprocating engine—and it is doubtful if we will see either one in high-volume, low-cost passenger cars soon. The free piston engine seems most promising at the moment because of the low cost and availability of material to make the engine.—**Reported by B. L. Taft for Hartford Chapter.**

Southwest Metal Show Scheduled for Dallas



Automobile Bldg., State Fair Park, Dallas, Tex.

THE FIRST SOUTHWESTERN METAL CONGRESS AND EXPOSITION will be held May 12-16, 1958, in the Automobile Bldg. at the State Fair Park in Dallas, an answer to the rapid growth of the metal industry in this vigorous section of the country.

Both the new Southwestern Show and the Western Show are expected to grow in size and importance as regional versions of the National Metal Exposition and Congress, now approaching its 39th year, and which alternates annually among Chicago, Cleveland and Philadelphia.

First edition of the Southwestern Show will be at a spacious facility, the State Fair Park at Dallas, a $35,000,000 permanent exposition plant, covering 187 acres. There are 60,000 sq. ft. of display space in the Automobile Bldg.

Thirteen A.S.M. chapters will cooperate as hosts for the Southwestern event. They are: North Texas (Dallas), Texas (Houston), Phoenix, New Orleans, Albuquerque, Rocky Mountain (Denver and Pueblo), Tulsa, Wichita, Salt Lake, Missouri School of Mines and Metallurgy, St. Louis, Nebraska and Louisiana.

Dramatic documentation of the extent to which Southwestern industry is booming is provided by results of an investigation and study which A.S.M. trustees reviewed before they approved establishment of a new Southwestern Metal Show in Dallas.

The results are not yet in complete report form, but preliminary highlights paint a startling growth picture and indicate the strong need for a Metal Show in the area of Dallas trade influence:

Number of manufacturing firms has increased recently by 370% in Texas, by 410% in Colorado, by 260% in Louisiana.

Value of manufacturing annually has increased from $57,000,000 to $1,068,000,000 in Texas; from $6,000,000 to $470,000,000 in Kansas, from $10,000,000 to $147,000,000 in Louisiana.

Dallas is now the hub of nine railroads, trucklines, three trunk airlines, three feeder airlines; it is equidistant from the east and west coasts; has a skilled labor pool; and it is particularly well situated geographically to serve the entire southern United States.

Metalworking industries are having a major role in the burgeoning growth of the Southwest. A recent survey by the Dallas Chamber of Commerce revealed that the largest number of manufacturing firms were in the nonelectrical machinery manufacturing and distribution category. Ranking second were metal products concerns.

Interesting also is the disclosure that in recent years the Dallas trade influence area has expanded to embrace an 11-state region—from Tennessee to New Mexico and from Colorado to the Gulf of Mexico.

The Dallas trade area long was thought to include Texas, New Mexico, Oklahoma, Arkansas, Louisiana, Mississippi and the western part of Tennessee. Now it is apparent that Dallas firms have extended their range to include also Colorado, Kansas, Missouri, Alabama and all of Tennessee.

Floor plans depicting space availabilities for the First Southwestern Metal Show have been sent out to industry, reports Chester L. Wells, assistant director.

"The large number of early inquiries about exhibit space indicates how right A.S.M. trustees were in giving the 'green light' for a Southwestern Show", commented Mr. Wells. "A real industrial sales opportunity exists at Dallas".

Sixth Mining Congress To Be Held in Canada

With the approval of the Commonwealth Council of Mining and Metallurgical Institutions, and on invitation of the Canadian Institute of Mining and Metallurgy, the Sixth Commonwealth Mining and Metallurgical Congress will be held in Canada in Sepember and October 1957.

An estimated 500 traveling delegates from all parts of the world are expected to arrive at Vancouver, B.C., on Sept. 8, 1957, and to travel across Canada by plane and train on a schedule calling for a final meeting in Halifax, N.S., on Oct. 9.

In addition to the cross-country tour, delegates will take an aerial tour of Northern British Columbia, the Yukon, Northwest Territories, Northern Saskatchewan and Northern Manitoba. Inspection visits will be made to over 50 major centers of industrial operations, including metal mines, coal mines, smelters and refineries, petroleum and natural gas wells, oil refineries, chemical and petro-chemical plants and steel plants, as well as other places of professional, technical and general interest. Formal meetings will be held at the larger population centers.

The General Committee for the Sixth Congress has extended an invitation to all members of professional and technical institutions and societies in the United States to attend the Congress, and an invitation has been extended by the American Society for Metals to all members attending the Sixth Mining Congress to participate in the Second World Metallurgical Congress.

Information about the Mining Congress may be obtained by writing to: Sixth Commonwealth Mining and Metallurgical Congress, 507-837 West Hastings St., Vancouver 1, B.C.

Tulsa Completes Metallurgy Course

The Tulsa Chapter Recently Completed a Course on "Modern Metallurgy for Engineers" at Tulsa University. The course covered the uses and applications of metals to modern design, with particular emphasis on the light metals. The instructor, shown standing behind the class group, above, was William M. Lorkovic, materials and processes engineering division, Douglas Aircraft Co. The student group included personnel from aviation, commercial manufacturing and petroleum processing industries and university students. (Reported by A. N. Stevens for Tulsa)

Discusses Brittle Fracture of Large Welded Structures

Speaker: W. S. Pellini
Naval Research Laboratory

At a joint meeting of the **Northeast Pennsylvania Chapter** and the American Welding Society, W. S. Pellini of the Naval Research Laboratory spoke on the "Metallurgical and Welding Aspects of the Brittle Fractures of Large Welded Structures".

Mr. Pellini reviewed briefly the history of brittle fractures, which were first observed in bridges which failed in Europe during the late 1930's but, for the most part, the true significance of these failures was not recognized at the time. In general, they were attributed to poor steel and little research was carried out. During World War II, when great numbers of ships were being fabricated by welding, numerous catastrophic failures were encountered, and brittle fractures have since been the subject of intensive study. While there are still a good many phases to the problem that are not completely understood, much has been learned and empirical solutions have been formulated for the guidance of the engineer who must proceed with design and manufacture of equipment to operate under conditions where brittle failures have been most frequently encountered.

Crack propagation speeds have been measured up to 6000 ft. per sec. Two critical transition temperatures should be recognized in connection with problems of brittle fracture, one is a transition for initiation of fracture and the other a transition for propagation of fracture. For conventional service, the initiation transition controls, while for severe loading conditions involving the application of local plastic loading, the fracture propagation transition is the controlling factor. For all steels investigated, there is a temperature (transition) below which yielding is not possible in the presence of a sharp, notch-like flaw; the metal will initiate fracture in preference to developing deformation. The fracture propagation transition occurs at approximately 30 to 40° F. above the transition for initiation. Above this temperature fractures will not propagate through elastic-loaded regions even though starting was "forced" by the application of deformation locally at the location of the notch.

The actual values for transition temperatures vary widely, depending on many factors, among which are chemical composition and microstructure. For example, it has been learned that steels having a quenched and tempered microstructure have lower transition temperatures than the same steels with normalized or pearlitic structures.

Numerous tests have been used in studying the brittle fracture problem, among them the explosive loading, dropweight and Charpy impact tests. The drop test is simple and inexpensive to conduct. In both of these tests, the crack is initiated by welding a small bead of hard facing material on the surface of the plate to be tested. This cracks with the initial very slight deformation and provides a notch of infinite sharpness, which may or may not penetrate into the balance of the material, depending on the properties of the test material. It has been found that the Charpy V impact test can be correlated with other results and service failures quite satisfactorily, but that the Charpy keyhole test is much less satisfactory.

An interesting question and answer period followed Mr. Pellini's talk.—**Reported by John P. Jacobs for Northeast Pennsylvania.**

Speaks on High-Temperature Alloys

E. N. Skinner, Head, Heat Resistant Materials Section, International Nickel Co., Inc., Spoke on the "Selection of Alloys for High-Temperature Service" at a Meeting of the Tulsa Chapter. Shown during the meeting are, from left: F. A. Dewey, secretary-treasurer; W. L. Smith, program chairman; Mr. Skinner; and G. R. Clay, chairman. (Reported by A. Stevens)

Metallurgical News and Developments

Devoted to News in the Metals Field of Special Interest to Students and Others

A Department of *Metals Review*, published by the
American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

Rectifier—A silicon carbide rectifier has been operated at temperatures up to 1200° F. at General Electric Research Laboratory. Similar devices made with other semiconductor materials, notably silicon, have been able to operate only up to the 400-500° F. range.

Refractory Cement—A refractory cement which will hold metal to metal, glass or ceramics at temperatures from −420 to 1000° F. has been developed by Charles Engelhard, Inc. Called CA-9, the adhesive is di-electric and highly shock-resistant throughout its temperature range, the upper limit of which can be extended to 1500° by modifying the composition. The cement was engineered to attach surface-temperature transducers, strain gages and lead wires to the skins of guided missiles.

Research Center—Purdue University has established a Thermophysical Properties Research Center to serve as a world center for research and for the collection, analysis, correlation and dissemination of data on thermophysical properties, and to provide facilities and opportunities for graduate study and research on these properties.

Belgium Congress—A World Congress of Iron Merchants will be held in Brussels, Belgium, June 11-14, 1958, during the 1958 Brussels Universal and International Exhibition. Information can be obtained from O. Saey, Manager, Groupement des Marchands de Fer et de Pourtrelles de Belgique, 10, Avenue Emile Duray, Brussels, Belgium.

To Mine Titanium—Plans for mining titanium minerals on Amelia Island, about 30 miles northeast of Jacksonville on the Florida Coast, have been announced by Union Carbide Corp. Construction of processing mill and auxiliary equipment will start shortly and mining is expected to begin next spring.

Add Offices—The Electrode Division of Great Lakes Carbon Corp. has announced completion of a new office building addition at its Niagara Falls, N. Y., plant. This building marks another step toward the Division's goal of a 45% increase in production of graphite electrodes, anodes, mold stock and specialties.

Gamma Inspection—The feasibility of inspecting fabricated nuclear reactor fuel elements by means of gamma radiography has been demonstrated in a series of experiments conducted at Battelle Memorial Institute for the AEC's Westinghouse-operated Bettis Laboratory.

Superbolts—Heat-defying steel superbolts that can hold together tomorrow's "hot" supersonic aircraft and permit major advances in high-temperature design in other fields have been announced by Standard Pressed Steel Co. With minimum tensile strength at 170,000 psi. at 900° F., the bolts are as much as 50% stronger than stainless and alloy steel fasteners currently used at this temperature.

Magnetic Materials Conference—A Conference on Magnetism and Magnetic Materials will be held in Washington, D. C., Nov. 18-20, by the American Institute of Electrical Engineers in cooperation with the American Physical Society, American Institute of Mining and Metallurgical Engineers, Institute of Radio Engineers, and the U. S. Office of Naval Research. Authors should submit titles of proposed papers by July 1 and abstracts by Aug. 15. For further details write: L. R. Maxwell, U. S. Naval Ordnance Laboratory, White Oak, Silver Springs, Md.

Rocket Department—Baldwin-Lima-Hamilton Corp. has set up a rockets and missiles department at the Standard Steel Works Division. The department will be the coordinating body for research, engineering, production and sales in the rockets and missiles field.

Special Course—The Engineering and Sciences Extension Division, University of California, will present its second annual summer program in "Nuclear Energy for Industry" in two sessions. The first, to be held July 1-Aug. 30, will be a short course for engineers who need a basic knowledge and facility in nuclear engineering to complement their current skills and experience; the second, to be held the week of July 8-12, will be a nuclear engineering survey for those who must plan and administer nuclear energy programs, look to the future, finance and direct the participation of their companies in the nuclear energy field. Information from: Engineering and Sciences Extension, Nuclear Energy Programs, Room 100, Bldg. T-11, University of California, Berkeley 4.

New Porous Metal—A porous metal sheet material for use in the aeronautical and other fields has been developed at Illinois Institute of Technology. The material is a continuous sintered sheet of felted metal fibers which can be varied over a wide range of porosities having high strength-to-porosity ratio.

Tin Oxide—Metal and Thermit's new prime metal tin oxide made by oxidizing molten tin instead of by chemically precipitating tin hydrate is said to be composed of extremely fine particles and free from deleterious ingredients or contaminants. It is used as an ingredient in colors and is said to be a color glaze stabilizer and as an opacifier for highest quality white glazes.

All-Metal Structures—Republic Steel Corp. has announced an all-metal "standard building" that can be delivered to the job site within two or three weeks after an order is placed. Manufactured by Republic's Truscon Division, the buildings are delivered with all siding, roofing, windows, doors and hardware included, and, to facilitate erection, Truscon construction men will be on hand when the building is delivered.

Reduces Lead Time—An electronically controlled machine tool that will substantially reduce "lead time" in the production of military planes and missiles has been announced by the Martin Co. and Bendix Aviation Corp. The new manufacturing system uses electronics to put coded information from a blueprint on tape and then read it in a 50-ton milling machine that automatically turns out finished, precision-built aircraft and missile structural parts.

Expansion—Crucible Steel Co. of America has announced a $1,500,000 expansion program for Vacuum Metals Corp., an operating division of its Sanderson-Halcomb Works at Syracuse, N. Y. The program is being undertaken to meet increased demand for vacuum-melted high-quality bearing and various high-temperature alloy steels.

Dallas Metal Show has been added — to your Sales Territory . . .

The great Southwest — the industrial Southwest—rich, growing, bustling — is waiting for you. Here's a new sales territory that means profits for modern-day pioneers.

There'll be thousands of *new* prospective customers who'll crowd the Southwestern Metal Show — to see your company's display — to hear your company's story — to buy your company's product.

Over two million people live and work within a day's drive of Dallas. They are your prospects, interested in all that's new and improved. This is a chance you can't afford to miss.

Mark those five days next May as the "Days that Pay". You'll find them just that, because thousands will be at the Dallas Metal Show, searching for production advantages that will help improve operations, services, products — and at lower costs.

These prospects will be ready to buy. They'll be "preconditioned" — for the great Southwest is on the march, sparking sales to improve its own business economy.

ASM Metal Shows are famous as sales stimulants. They are "musts" for any firm with an eye on an expanded tomorrow. Here in the Southwestern Metal Show is a rich metal market full of opportunity for the prospecting manufacturer. Here's a show that will out-draw, out-sell and surpass anything you've experienced before in the "great open spaces."

STATE FAIR PARK

DALLAS, TEXAS

MAY 12-16, 1958

Because the Show is staged in Dallas' spacious State Fair Park, only two miles from the city's center and downtown hotels, you'll be able to put your best foot forward before a top level audience looking for just what you've got to offer. There never was a finer exhibition hall — all on one level — airy, bright. It puts visitors in the right frame of mind to buy. It will be bristling with ideas and thronged with buyers.

Get your share of this new market. The Southwestern Metal Show is the place to sell! Act today — select your space. If you don't have floor plans, write us NOW. You'll reap a harvest from this new and finer Metal Show. To assure success in '58 — Don't Hesitate!

Southwestern Metal Exposition

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State Fair Park Is Only Two Miles from Downtown Hotels

METAL SHOWS OWNED AND OPERATED BY THE AMERICAN SOCIETY FOR METALS

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month

Prepared at the Center for Documentation and Communication Research,
Western Reserve University, Cleveland,
With the Cooperation of the John Crerar Library, Chicago.

Annotations carrying the designation (CMA) following the reference are published also in *Crerar Metals Abstracts*.

General Metallurgy

186-A. Working With Manganese. W. Schweisheimer. *Australasian Engineer,* no. 45, Feb. 7, 1957, p. 86-88.

Observations on conditions causing manganese poisoning, symptoms of poisoning and control measures. (A7q; Mn)

187-A. Main Metal: Light Alloy for Casting and Extrusion. *Australasian Manufacturer,* v. 41, Feb. 9, 1957, p. 72-81.

Composition, properties and applications of main metal (zinc-aluminum alloy). (A general; Zn, Al, 4-8, 5)

188-A. How Much Manganese to Malign? W. Schweisheimer. *Canadian Machinery,* v. 68, Mar. 1957, p. 114-115.

Manganese poisoning and steps necessary for its prevention. (A7q, Mn)

189-A. New Method for Eliminating Poisons From the Effluents of Hardening Plants and Plating Shops. Werner Peters. *Draht (English Edition),* no. 27, Feb. 1957, p. 34-38.

Lancy process based on adequate preliminary rinsing followed by neutralization prevents toxic chemicals from reaching effluent waters; process details for chromate and cyanide wastes. (A8b)

190-A. Titanium. R. L. Preece. *Inspection Engineer,* v. 20, May-June 1956, p. 61-63, 71. (CMA)

Occurrence, physical and mechanical properties, corrosion resistance, processing, fabrication, electrodeposition, welding and brazing of titanium are reviewed. (A general; Ti)

191-A. A Castable High-Strength Aluminum Alloy. *Precision Metal Molding,* v. 15, Mar. 1957, p. 48, 58.

North American Aviation has developed a new castable alloy for aircraft use with an ultimate tensile strength of 46,000 psi. and a tensile yield of 36,000 psi. The new material, known as 42B, is similar in composition to alloy 356. (A general, E25p, Q27a; Al)

192-A. New—A High Strength Stainless Alloy. *Precision Metal Molding,* v. 15, Mar. 1957, p. 63, 87-88.

Development of a new castable alloy, tentatively designated as CD-4MCu, possessing both excellent mechanical properties and the same corrosion resistance characteristics of 18-8 stainless steel. (A general, E25p, Q general; SS)

193-A. Iron Ore Resources of New Zealand. J. Luke. *New Zealand Department of Scientific and Industrial Research,* Information Series—Bulletin 6, 1955, 28 p.

Reserves of iron-sand, limonite and ilmenite ore tabulated. (A11a; Fe, RM-n)

194-A. (French.) **A New Type of Copper With Phosphorus.** *Cuivre Laitons Alliages,* no. 35, Jan.-Feb. 1957, p. 35-37.

Deoxidized copper with phosphorus is particularly well qualified for brazing and welding, possesses such advantages as greater speed in hot and cold working. Consideration of electrical conductivity and annealing temperature as functions of phosphorus content. (A general; Cu, *P*)

195-A. (French.) **Management of Scrap.** J. Pennel. *Cuivre Laitons Alliages,* no. 35, Jan.-Feb. 1957, p. 39-44.

Sorting and storing of scrap according to type of metal, nature of pieces (welded, brazed, chromium-plated, etc.), form (sheets, bars, tubes); elimination of ferrous metals; preparation of scrap for pressing; methods of transferring scrap; wooden cases are compared with sacks as vehicles of conveyance. (A11d, S10; RM-p)

196-A. (French.) **Report on Iron and Steel. (Annual Review: Evolution of Production and Investments).** G. Grenier. *Echo des Mines et de la Metallurgie,* Jan. 1957, p. 23-25.

Survey of iron and steel production and investment up to the end of 1955; preparation of ores in the United States, European countries and the Soviet Union; blast furnace capacities and methods of blasting; new techniques and recent progress in the steel industry, enumeration and description of new processes. (A4p, D general; ST)

The subject coding at the end of the annotations refers to the revised edition of the ASM-SLA Metallurgical Literature Classification. The revision is currently being completed by the A.S.M. Committee on Literature Classification, and will be published later in the year. A schedule of the principal headings in the revised version was published in the February issue.

197-A. (French.) **Electrical Energy and Aluminum.** *Journal du Four Eléctrique,* no. 6, Nov-Dec. 1956, p. 193-194.

In the United States the aluminum industry consumes approximately 5% of the total electrical energy produced; consideration of the connection between electrical consumption and aluminum production and the possibilities of the use of other sources of energy such as coal and natural gas. (A11, 16-11; Al)

198-A. (French.) **Development of the Aluminum Industry in the U.S.S.R.** *Journal du Four Eléctrique,* no. 6, Nov-Dec. 1956, p. 211.

Predictions concerning the possible evolution of the Russian aluminum industry in the foreseeable future. The Soviet government has announced its intention of raising aluminum production, by 1960, to the 1,200,000 (metric) tons per year level. The Soviet Union is expected therefore to move ahead to second place among the world's aluminum-producing countries. (A4p; Al)

199-A. Metallurgy at Canada's "Mines Branch". Harold J. Roast. *Metal Progress,* v. 71, Apr. 1957, p. 74-77.

Fifty years ago a research organization was authorized by the Canadian Government. Now its personnel numbers over 600 in the six divisions, of which 146 are in physical metallurgy—a term broad enough to include foundry practices on the one hand and superpurity metals on the other. (A9h)

200-A. A Dictionary of Metallurgy. A. D. Merriman and J. S. Bowden. *Metal Treatment and Drop Forging,* v. 24, Mar. 1957, p. 107-114.

From "xenon" to "zwitter ions". (A general, 11-17)

201-A. Copper and Copper Alloys. A Survey of Technical Progress During 1956. E. Voce. *Metallurgia,* v. 55, Mar. 1957, p. 109-120.

Outlines principal publications dealing with copper and copper alloys during 1956 in following fields: raw material resources, extraction, foundry practice, forming or working processes, finishing, plating, sheet treating, mechanical properties, applications, corrosion, joining, powder metallurgy, physical properties, inspection, testing and analysis. 276 ref. (A general; Cu)

202-A. The Metal of the Future. A. D. McQuillan. *New Scientist,* Feb. 21, 1957, p. 29-31. (CMA)

Review of the history, occurrence, importance and present industrial status of titanium. The Wilton plant of ICI is described; a sodium reduction process is carried out in the presence of a protective atmosphere. (A general, C26; Ti)

203-A. Zirconium and Hafnium. A Bibliography. Gordon C. Williams, E. G. Baker, Jr., E. W. Holzknecht and R. G. Moody. University of Louisville. *U.S. Atomic Energy Commission,* NYO-1003, May 1950, 236 p.

Result of a thorough search of *Chemical Abstracts* from 1907 through 1948. Includes an almost complete listing of all references to either zirconium or hafnium appearing therein. (A general; Zr, Hf)

204-A. Comprehensive Report of Exploration by the Bureau of Mines for Thorium and Radioactive Black Mineral Deposits. D. E. Eilertsen and F. D. Lamb. Bureau of Mines. *U.S. Atomic Energy Commission,* RME-3140, June 1956, 46 p.

Exploration work done on 49 projects located in Western and Northwestern U.S. including Alaska (39) and Southeastern U.S. (10). All deposits investigated were placers except one, in Wyoming, which is a lode deposit. (A11a; Th, 14-9)

205-A. Bibliography of Zirconium. E. Abshire. *U.S. Bureau of Mines Information Circular* 7771, Mar. 1957, 281 p. (CMA)

An exhaustive bibliography of the literature published from 1907 to date for zirconium and hafnium. Some 645 patents and 969 journal references with abstracts are included. Reference sources used are enumerated. The journal and patent sections are arranged alphabetically by authors and followed by subject indexes, secondary authors are cross-indexed. (A general; Zr)

206-A. Hazards and Safety Precautions in the Fabrication and Use of Titanium. F. D. Peterseim. Battelle Memorial Institute, Report 63. *U.S. Office of Technical Services,* PB 121623. Jan. 1957, 25 p. (CMA)

Producers, fabricators and users of titanium were contacted and a literature survey was made to determine the degree of hazard with titanium. The discussion covers fire hazards in processing and preparing titanium, reactions with nitric acid, storing and handling sponge, and the explosive aspects of titanium powder. (A7p; Ti)

207-A. The Hot Forming, Assembly and Service Applications of Magnesium Alloys. R. G. Wilkinson. *Welding and Metal Fabrication,* v. 25, Mar. 1957, p. 101-107.

Mechanical properties and chemical compositions of common magnesium wrought alloys including die materials, preforming considerations, forming operations, mechanical joining, welding and adhesive bonding, surface protection and applications. 9 ref. (A general; Mg)

208-A. Progress in Western Metalworking. *Western Metals,* v. 15, Mar. 1957, p. 69-95.

Recently adopted methods and new development in metalworking industry in western U.S., including notes on casting, cutting, finishing, forging, forming, heat treating, machining, joining, testing and materials handling. (A general)

209-A. (French.) **Reflections on Works Organization for Fabrication by Welding With a View to Increasing Productivity.** G. Repeczky. *Soudage et Techniques Connexes,* v. 11, Jan.-Feb. 1957, p. 5-21.

Detailed analysis of welding processes from the point of view of productivity; notes the relative roles played by the design, production, planning and management departments; suggests rules and principles and various ways of calculating time and costs, together with methods of work to improve efficiency and lower costs.
(A5, A4s, K general)

210-A. (French.) **Activities of the Office Central et Institut de Soudure in the Field of Research.** A. Leroy. *Soudage et Techniques Connexes,* v. 11, Jan.-Feb. 1957, p. 39-45.

Outline of the research problems raised by the development of welding applications comprehending a considerable number of industries and techniques; consequent work undertaken on a joint basis or in liaison with other research centers at the national and international levels. (A9h, K9)

211-A. (German.) **Current Economic and Technological Situation in the Field of Titanium.** Richard Kieffer and Friedrich Benesovsky. *Berg- und Huettenmaennische Monatshefte,* v. 101, Dec. 1956, p. 292-300. (CMA)

Current prices of various titanium-containing products (titanium slag, rutile concentrate, titanium dioxide, etc.) and of various titanium ores. After a brief review of the historical development of titanium metallurgy and of the present state of industrial titanium production, future possibilities of cheaper procedures are discussed. 9 ref.
(A4s, C general; Ti, RM-n)

212-A. (German.) **Some Problems of Research on New Light Metal Alloys.** D. A. Petrov. *Acta Technica Academiae Scientiarum Hungaricae,* v. 16, 1957, p. 121-129.

The production of high-purity aluminum; the crystallization of cast light metal ingots, more particularly the behavior of impurities. Development of the aluminum-copper, aluminum-copper-magnesium, aluminum-copper-magnesium-manganese, aluminum-magnesium-zinc and finally of the so-called superalloys and their use in jet aircraft.
(A general, N12, T24; Al)

213-A. (German.) **Titanium—the Metallic Industrial Material of the Future.** W. Hess. *Technica,* v. 6, Mar. 1, 1957, p. 197-202. (CMA)

A general survey of the preparation, physical, mechanical and chemical properties, processing and the applications of titanium. A flow sheet illustrates the various titanium production methods, and the major properties of the metal are shown in tables and graphs. 10 ref.
(A general; Ti)

214-A. (Spanish.) **The Teaching of Welding in France, Belgium and England. Conclusions and Proposal of Plan for Training Journeymen and Master Welders.** *Ciencia y Técnica de la Soldadura,* v. 7, Jan-Feb. 1957, 18 p.

Survey of instruction available and sponsorship in the three countries; proposes plan for overcoming shortage of skilled welders in Spain and maintaining adequate supply in future. (A3, K general)

215-A. Ship-Plate and Constructional Steels. A. M. Sage. *Iron and Coal Trades Review,* v. 174, Apr. 12, 1957, p. 849-852.

Demand for ship-plate and constructional steel is already exceeding the supply and is certain to increase; important factors include use of bessemer steel, changes in casting and rolling practice and prevention of brittle-type fractures in welded structures.
(A4p, T22g; ST, SGB-s)

216-A. Production Engineering Research. *Mechanical World and Engineering Record,* v. 137, Apr. 1957, p. 176-178.

Research being carried on by the Production Engineering Research Association on machining, stamping, machine tools, impact extrusion, tool grinding, deburring, cutting fluids, automation, deep drawing, reaming and surface finishing.
(A9m, G general)

217-A. Production of Ilmenite in Western Australia. J. A. Dunn and

A.S.M.-W.R.U. Program Ready for Test Runs

The pilot plant mechanized literature searching project being conducted for the American Society for Metals at Western Reserve University has now reached the initial testing stage. More than 5000 abstracts representing much of the important metallurgical literature of 1955 have been processed and will be ready for machine searching in September. An experimental searching selector has been built at the Center for Documentation and Communication Research at Western Reserve University which can be used to make test searches.

members are urged to participate in the test program by submitting typical questions and subjects for literature searches. A limited number of searches will be made covering only the literature of 1955. For those problems selected, pertinent information retrieved will be sent to the inquirer at no charge.

For details, write:

American Society for Metals
Attention: Marjorie R. Hyslop
7301 Euclid Ave.
Cleveland 3, Ohio

J. W. Morgan. *Mining Journal*, v. 248, no. 6345, Mar. 29, 1957, p. 400-401. (CMA)

Ilmenite recovery operations in Western Australia by Western Titanium N. I. and Cable Ltd.; Westralian Oil Ltd. is planning to enter the industry. The ilmenite of Western Australia has a low chromium content and is suitable for pigment manufacture. Freight and production costs are considered. Projected West Australian production would represent less than 20% of the world's total. (A11a; Ti)

218-A. The World's Uranium. C. F. Davidson. *New Scientist*, Feb. 21, 1957, p. 9-11.

Known deposits in non-Communist countries are at least a million tons. Many sources are being exploited in the occupied countries, and, with 25,000 geologists available, it seems certain that big deposits will be found in Russia itself. (A11a; U)

219-A. Demand for Aluminum Expected to Double Within Decade; 1957 Shipments Likely to Rise 5 to 10%. R. L. Sheneman. *Waste Trade Journal*, Apr. 13, 1957, p. 26-28.

Existing and planned capacity in free world outside U.S. indicates an expansion by 1960 sufficient to raise annual use 50% above 1955 level. (A4p; Al)

220-A. (English.) Association of French Steel Casting Manufacturers. *Aciers Fins & Speciaux*, no. 25, Mar. 1957, p. 6-8.

Description of the various groups included in this organization (A.S.F.R.A.M.). The association is nonprofit and endeavors to establish early technical liaison between founder and user, foster research and advise its member firms. (A12g; ST, 5)

221-A. (English.) Alloy Steel Castings. *Aciers Fins & Speciaux*, no. 25, Mar. 1957, p. 27-34.

Types of special steels most frequently encountered in French production of parts cast in special steel; includes consideration of 12% manganese steels, engineering alloy steels, stainless steels and heat resisting steels; composition, heat treatment and properties of each type are specified, together with applications. (A general; AY, 5)

222-A. (French.) Mechanical Ventilation of Laboratories. *Journal d'Informations Techniques des Industries de la Fonderie*, no. 84, Feb. 1957, p. 17-20.

Necessity in laboratories devoted to the analysis of metals of providing adequate ventilation for the dispersal of acid vapors; ventilation methods currently in use. (A8a, W10)

223-A. (French.) The Liege-Charleroi Basin and Its Contribution to Europe. *Metallurgie.et la Construction Mecanique*, v. 89, Mar. 1957, p. 219-231.

Diversity and importance of Belgian industry; coal, coke, iron and steel production; raw materials, production and sales; wiredrawing and foundries; Association of Belgian Blast Furnaces and Steel Works; list of producers with their types of products.
(A4n, D general, F general; ST)

224-A. (German.) Production Expansion as Determining Factors for Basic Research in the Field of the Chemical Technology of Light Metals. H. Ginsberg. *Metall*, v. 11, Mar. 1957, p. 176-179.

Estimate of production expansion. Process developments in the aluminum field caused by production expansion. Process developments in other light metals (magnesium, titanium, beryllium). 14 ref.
(A4p, A9k; EG-a39)

225-A. (Italian.) Brass and Zinc Among the Ancients. Giovanni Rolandi and Giovanni Scacciati. *Industria Mineraria*, v. 7, Nov. 1956, p. 759-770.

Processes and equipment, chemical and physical analyses, uses of these metals as deduced from early Greek and Roman literature, surviving objects and fragments, other historical sources. (A2; Cu-n, Zn)

226-A. (Portuguese.) Description of a Brazilian Alloy Steel Mill. Luiz Dumont Villares. *Engenharia, Mineracao e Metalurgia*, v. 24, Nov. 1956, p. 297-301.

Acos Villares, S. A. (Villares Steel Co.) plant in Sao Caetano do Sul, state of Sao Paulo. Production program, future expansion plans, raw materials, equipment; technical and personnel problems. (A4p, A5; AY)

227-A. (Portuguese.) Problem of Brazilian Iron Ores as Seen by a Geologist. John Van N. Dorr, II. *Engenharia, Mineracao e Metalurgia*, v. 24, Dec. 1956, p. 365-373.

Nature and origin of potential reserves of iron ores in state of Minas Gerais; marketing aspects, both technical and economic.
(A11a, A4q; Fe, RM-n)

228-A. (Portuguese.) A Metallurgical Institute. Waldemar de Lima e Silva. *Engenharia, Mineracao e Metalurgia*, v. 25, Dec. 1956, p. 379-382.

Outlines need for information and research center in Brazil; proposes joint government and industry support; suggests lines of research, publication of a metals journal, organization and curriculum of courses in metallurgical engineering and metallurgical science. (A9, A3)

229-A. (Portuguese.) Figures Are Proof. Production Increasing at Volta Redonda. *Engenharia, Mineracao e Metalurgia*, v. 24, Dec. 1956, p. 391-392.

Production figures for coke, pig iron, steel ingots, strip, hot and cold rolled strip, etc., for January-September, 1955 and 1956. Current uses in metal building construction.
(A4p, T26n; Fe, ST)

230-A. (Swedish.) Utilization of Low-Grade Ores: Problems Concerning the Future Supply of Minerals. P. G. Kihlstedt. *Jernkontorets Annaler*, v. 141, no. 1, 1957, p. 1-27.

Survey of raw material situation from the point of view of policy, technical developments, consumption and price trends. Importance of international cooperation and of better education of mining engineers and metallurgists. 18 ref.
(A4p, A3; RM-n)

231-A. (Pamphlet.) Applications and Properties of Zirconium and Alloys. 7 p. 1957. Columbia-National Corp., 70 Memorial Dr., Cambridge 42, Mass.

Sources of information pertaining to the applications and the mechanical, physical, electrical, chemical and nuclear properties of zirconium and its alloys have been collected and tabulated for those who may be considering the use of zirconium.
(A general; Zr)

232-A. (Book.) Properties of Aluminium and Its Alloys. Bulletin #2, Revised Ed. 204 p. 1955. The Aluminium Development Association, 33 Grosvenor St., London W1, England. 7s.6d.

Information and data including brief classification of main groups of aluminum materials and physical properties. Note on nomenclature of British standards and aircraft specifications and tabulated data of aluminum materials, including compositions and mechanical properties indicating proprietary names of many compositions; brief note on mechanical test requirements and test methods and characteristics of aluminum in certain fields such as super-purity alloys, foil, electrical conductors, sintered alloys; outline of characteristics affecting design; guide to alloy selection.
(A general, Q general, Al)

233-A. (Book.) Process and Physical Metallurgy. Revised Ed. James E. Garside. 593 p. 1956. Charles Griffin & Co. Ltd., 42 Drury Lane, London W.C. 2, England. 54s.

Written from the standpoint of the user of metallic materials, particularly from the engineer's angle. Covers fuels, refractories, furnaces, molding materials, pyrometry, mechanical deformation, heat treatment, and the joining of metals, arranged in relationship to the theoretical aspects of metallurgical science. Two new chapters have been incorporated—on powder metallurgy and on corrosion.
(A general)

234-A. (Book.) Materials of Construction. Adelbert P. Mills, Harrison W. Hayward and Lloyd F. Rader. 6th Ed. 650 p. 1955. John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y. $7.50.

Text for engineering students; includes sections on structure, constitution, tests, service requirements and sources of metals; outlines properties of pig iron, steel, wrought iron, cast iron, malleable cast iron, alloy steels and nonferrous metals.
(A general; SGB-s)

235-A. (Book—German.) Gmelin's Handbook of Inorganic Chemistry. System No. 28. Calcium, Part A, Section 2. 8th ed. 420 p. 1957. Verlag Chemie, GmbH, Weinheim-Bergstrasse, West Germany. $55.68.

Deals with the occurrence of calcium, elemental calcium and calcium alloys. Covers the industrially important deposits of fluorspar calcium phosphate and the known deposits of Iceland-spar as well as briefly reviewing economically significant gypsum and anhydrite deposits. (A general; Ca)

236-A. (Book—German.) Gmelin's Handbook of Inorganic Chemistry. System No. 68. Platinum, Part D. 8th ed. 638 p. 1957. Verlag Chemie, GmbH, Weinheim-Bergstrasse, West Germany. $90.

Treats 2880 platinum compounds. A formula index arranged by type and number of neutral ligands; simplifies locating of individual compounds. Numerous cross references to related compounds treated in different chapters which facilitates general orientation. (A general; Pt)

237-A. (Book—German.) Gmelin's Handbook of Inorganic Chemistry. System No. 32. Zinc. 8th ed. 1025 p. 1956. Verlag Chemie, GmbH, Weinheim-Bergstrasse, West Germany. $138.

Treats the element zinc, its compounds and alloys. An entirely new chapter on the geochemistry of zinc has been added to the material on occurrence. The metallurgy of zinc is fully presented including the processes which precede the recovery of the metal itself. (A general; Zn)

B Ore and Raw Material Preparation

39-B. Cominco's New Sinter Plant. E. A. Mitchell, J. F. Melvin and R. Bainbridge. *Journal of Metals,* v. 9, *AIME Transactions,* v. 209, Mar. 1957, p. 361-370.

Design and operation of plant for sintering material for lead smelter. High proportion of zinc plant residue requires specialized techniques; mixing, drying, sintering and sinter crushing operations.
(B16a, 1-2; Pb, Zn)

40-B. Selenium and Tellurium Recovery From Canadian Ores. L. E. Djingheuzian. *Mining Journal,* v. 248, Feb. 15, 1957, p. 210-211.

Selenium and tellurium occur as copper selenides and copper-gold tellurides in the copper-nickel ore. Both metals are present in exceedingly small quantities. Procedure for extraction and refining is described.
(B general, C general; Se, Te, RM-n)

41-B. How Otanmaki Floats Ilmenite From Finland's Titaniferous-Magnetite. U. Runolinna. *Mining World,* v. 19, Apr. 1957, p. 49-55, 96. (CMA)

The government-owned Otanmaki Co. of Finland is now Europe's largest vanadium producer; ilmenite is also produced. Ore concentration is discussed. The ore is crushed in open circuit in three stages and wet-cobbed in the concentrator before grinding. The magnetic fraction is ground, the magnetite is separated magnetically and the pyrite and ilmenite are floated in respective stages. The requisites for the crushing plant are enumerated. Flotation cells and other units are described. Flow sheets are shown.
(B13, B14; Ti, V)

42-B. Salt Roast, Hot Water Leach, and H_2SO_4 Precipitation Recover V_2O_5. M. Merenmies. *Mining World,* v. 19, Apr. 1957, p. 55. (CMA)

Otanmaki magnetite averages 0.5% vanadium. The latter is recovered by mixing the magnetite concentrate with salt, ball milling, and pelletizing the pulp. Small balls of pulp are fed into pelletizing furnace, and the burnt pellets are removed into a counter-current leaching system using hot water. The leachate is treated with H_2SO_4 to precipitate vanadic acid. The precipitate is then purified, fused and cast into flakes. Production began July 1956. (B16b, C19n; V)

43-B. Some Technological Implications of Fundamental Research. W. F. Ford. *Refractories Journal,* Feb. 1957, p. 76-80, 87.

Refractory studies, phase equilibrium diagrams, silica brick quality, steel ladle linings, chromium-magnesite bricks and magnesite bricks.
(B19; RM-h)

44-B. Radioactive Tracer Investigations in a Flotation Circuit. G. G. Eichholz, W. B. Muir, M. J. S. Bennett, J. D. Wild, C. Lawton and S. Mostowy. *Canadian Mining and Metallurgical Bulletin,* v. 50, Mar. 1957, p. 121-127. (*Transactions,* v. 60, 1957, p. 63-69.)

Experiments carried out with copper sulphate formed with copper-64 and radioactive zinc ore in actual mill circuit to estimate effectiveness of tracer method in establishing contact times; particle distribution and recirculation; results recorded on adding copper sulphate tracer to zinc flotation circuit and radioactive zinc ore to normal mill feed.
(B14h, 1-4; Zn, RM-n)

45-B. Development of Tungsten Ore Dressing Practice. H. H. Kipp. *Canadian Mining and Metallurgical Bulletin,* v. 50, Mar. 1957, p. 134-136. (*Transactions,* v. 60, 1957, p. 76-78.)

Description and flow diagram of processes used in treatment of scheelite by gravity concentration and scheelite flotation showing change of the role of flotation.
(B14h; W, RM-n)

46-B. Tungsten Milling and Current Metallurgy at Canadian Exploration Limited. R. J. McLeod. *Canadian Mining and Metallurgical Bulletin,* v. 50, Mar. 1957, p. 137-142. (*Transactions,* v. 60, 1957, p. 79-84.)

Equipment and processes used in milling, sulphide flotation, tabling, thickening, scheelite flotation, leaching, drying and blending of tungsten ore. (B13, B14; W, RM-n)

47-B. Flotation of Iron Sulfides From Zinc Tailings of Southwestern Wisconsin Lead-Zinc District. T. A. Evans, J. W. Pennington and R. A. Wasson. *U.S. Bureau of Mines,* Report of Investigation 5324, Mar. 1957, 9 p.

Investigation of the flotation of iron sulphides from zinc-lead mill tailings. The sulphur content of the iron sulphide concentrates produced ranged between 39.87 and 47.23%, representing recoveries of 73.8 to 84.9% of the total sulphur.
(B14h; Fe, Zn, Pb)

48-B. Dehydration of Bauxites of Different Origins. V. N. Krylov and A. S. Polubilova. *Journal of Applied Chemistry of the USSR,* v. 29, May 1956, p. 759-764. (Translated by Consultants Bureau, Inc., 227 W. 17th St., New York 11, N.Y.)

Dehydration of bauxites begins in the range 220-470° C., and depends on the nature of the bauxite and its grain size. The temperature ranges in which most of the crystallization water is removed have been determined for bauxites of different origins and grain sizes. Bauxites heated below the temperature of total dehydration have considerable degree of hygroscopicity, which depends on the ignition temperature and humidification condition. (B14p; Al, RM-n)

49-B. New Horizons for Lithium. P. E. Landolt. *Mining Engineering,* v. 9, Apr. 1957, p. 460-464.

Lithium ore deposits in United States; methods of mining and recovery processes. 10 ref.
(B general, A11a; Li)

50-B. Fuel for Sinter Plants. V. S. Pisarev. *Henry Brutcher Translation* no. 3882, 2 p. (From *Stal',* v. 16, no. 7, 1956, p. 585-586.) Henry Brutcher, Altadena, Calif.

Comparative experiments on the use of nut-size anthracite and anthracite fines, as against coke breeze (minus ¾ and minus 1 in.) as fuels for sinter plants. Numerical data on fuel consumption, strength and lump size of sinter, and the specific output of the plant. Merits of inexpensive anthracite fines as sinter-plant fuel. (B16a; Fe, RM-j)

C Extraction and Refining

113-C. Zone Melting of Uranium. C. I. Whitman, V. Compton and R. B. Holden. *Electrochemical Society Journal,* v. 104, Apr. 1957, p. 240-244.

A study of the possible application of the zone melting technique to the separation of uranium from fission products and other impurities. Bar specimens of uranium having various alloying elements were zone purified in thoria-coated alumina boats. Uranium bars previously irradiated in the Brookhaven pile were also zone melted. Zone melting has potential application in the removal of such impurities as boron, iron, silicon, nickel and cobalt from ordinary uranium. 6 ref. (C28k; U)

114-C. Purification of Plutonium by a Thenoyltrifluoro-Acetone (T.T.A.) Process. J. G. Cuninghame and G. L. Miles. *Journal of Applied Chemistry,* v. 7, Feb. 1957, p. 72-81.

Extraction of plutonium by thenoyltrifluoro-acetone in the presence of impurities discussed and data presented for the extraction of uranium, zirconium, ruthenium, iron and chromium. A block flow-sheet for the purification of 1 g. of plutonium from 10 g. of uranium and one curie of zirconium is given.
(C19; Pu, U, Zr)

115-C. Electrolytic Titanium—Pt. III. R. S. Dean. *Metal Industry,* v. 90, Mar. 8, 1957, p. 193-194. (CMA)

Equipment for conventional fused electrolysis is not suited to the process of the Chicago Development Corp. since titanium ion concentrations are low. The anode must be disposed around the cathode to provide the minimum diffusion path. Cells of different sizes and their performances are described. The cathode deposit comes as a thin plate, a layer of fine crystals and an outer dispersion of coarse crystals; most of the salt bath is easily removed. The titanium loss from solution into the salt bath is minimized by having a salt containing 5% soluble titanium. Anode loss depends on its composition. Operating conditions are prescribed. (C23p; Ti)

116-C. Fundamental Studies on Copper Smelting. Pt. V—Mutual Dissolution Between Matte and Slag Produced in System Cu_2S-FeS-FeO-SiO_2. Akira Yazawa. *Tohoku University, Technology Reports,* v. 21, no. 1, 1956, p. 31-50.

The separation of the melt into matte and slag is ascribed mainly to the existence of silica and cuprous sulphide, especially of silica. In an actual matte smelting furnace the matte-slag system contains lime, aluminum, etc., which decrease the mutual solubility in addition to the presence of comparatively large amounts of silica and cuprous sulphide, so that a perfect separation between slag and matte is always brought about in practice. 6 ref.
(C21; Cu)

117-C. (German.) **Refining of Gold Alloys Containing Palladium by Means of Pulsating Direct Current.** J. Steiner and O. Adlhart. *Metall,* v. 11, Feb. 1957, p. 113-116.

Under suitable electrolytic conditions not only the advantages of the pulsating direct current can be

utilized, but also a lower palladium content of the cathodes can be obtained at the same current densities. 5 ref. (C23p; Au, *Pd*)

118-C. (Portuguese.) Extraction of Zinc From Silicated Ores by Means of Hydrometallurgy. Hugo Lodewijk Radino. *A B M, Bulletin of Brazilian Metals Society,* v. 45, Oct. 1956, p. 355-366.

Utilization of silicated zinc ores formerly prevented by formation of gelatinous siliceous acid which does not permit filtration of suspension of lixiviated ore. New patented lixiviation process eliminates this difficulty. 5 ref. (C19n; Zn, RM-n)

119-C. (Russian.) Metal-Reduction Methods in Chemistry and Technology. G. V. Samsonov and Yu. D. Chistyakov. *Uspekhi Khimii,* v. 25, Oct. 1956, p. 1223-1248.

Work on the reduction of metals and some nonmetals (silicon) with metals is reviewed. Reference is made to the use of metal hydrides as reducing agents in processes of this type. The physico-chemical aspects of the processes involved are discussed in detail. (C26)

120-C. (Russian.) Separation and Purification of Elements by the Rectification Method. Pt. I. Separation of Zirconium From Hafnium by the Distillation of the Products of the Interaction of Their Tetrachlorides With Phosphorus Oxychloride. L. A. Nisel'son and M. I. Kalinin. *Zhurnal Neorganicheskoy Khimii,* v. 1, Dec. 1956, p. 2657-2669.

Selection of the right type of column is of importance so the separation of these two elements by distillation may be successfully accomplished. The experimental results demonstrate that the distillation can be efficiently conducted in a column with perforated plates. (C22h; Zr, Hf)

121-C. Refractories for Melting and Casting Uranium and Other Metals. S. D. Stoddard and W. T. Harper. *American Ceramic Society Bulletin,* v. 36, Mar. 1957, p. 105-108.

The various pure oxide refractories employed in melting and casting uranium, uranium alloys and other metals; purity of the refractories and their methods of fabrication; coating materials and methods of applying them to molds and crucibles; a typical vacuum furnace installation for melting uranium alloys; details of the various furnace refractory components and their fabrication methods. (C5; U, RM-h)

122-C. Pilot Plant Testing of Uranium Ores at the Mines Branch, Ottawa. W. A. Gow, H. W. Smith and R. Simard. *Canadian Mining and Metallurgical Bulletin,* v. 50, Mar. 1957, p. 128-133. (*Transactions,* v. 60, 1957, p. 70-75.)

Description of acid leach pilot plant involving feed preparation, leaching and solution recovery for testing suitability of treatment process for uranium ores. (C19n; U)

123-C. Studies on Electro-Refining of Silver. G. C. Mitter. *Indian Institute of Metals, Transactions,* v. 8, 1954-55, p. 15-34.

Several methods of silver electrorefining; new processes and mechanisms of reaction. (C23p; Ag)

124-C. Titanium Metallurgy—I. Announce Method for Reduction of Titanium Chloride by Solutions of Alkalinious Metals in Their Fused Salts. R. S. Dean, W. W. Gullett, F. X. McCawley and I. Hornstein. *Industrial Laboratories,* v. 8, Apr. 1957, p. 4-7. (CMA)

Titanium can be formed electrolytically from a fused bath of alkali chloride and titanium chloride at cell voltages below the decomposition potential of the alkali chloride. These supersaturated solutions from which titanium crystallizes are most simply formed by electrolysis in a diaphragm cell. The anodic potential of the titanium electrode has been determined in an H cell of Ag/AgCl/$TiCl_{2-3}$/LiCl/KCl composition; the cell potential was constant at 0.70 v. at 100 ppm. of $TiCl_2$, yielding 1.75 v. for the anode potential. The crystals may also be produced by direct addition of sodium and titanium chloride. 14 ref. (C23p; Ti)

125-C. Commercial High-Purity Titanium and Titanium Alloys. H. Kusamichi, Y. Yagi and T. Yukawa. *Japan Institute of Metals, Journal,* v. 21, Jan. 1957, p. 1-10. (CMA)

A comparative study of the consumable electrode and nonconsumable electrode, arc melting furnaces for titanium alloys was conducted; capacities were 50 lb. and 1 lb., respectively. Cast ingots of sound internal structure are produced by consumable electrode arc melting. The alternative method has less thermal efficiency, produces internal defects in the ingot and contaminates the ingot with tungsten unless the electrode tip is watercooled. Supersonic inspection was adopted. (C5h; Ti-a)

126-C. Evaluation of the Hafnium Melting, Forging, and Rolling Work Conducted by the Crane Co. D. N. Dunning. *U.S. Atomic Energy Commission,* KAPL-M-DND-2, Jan. 22, 1957, 21 p. (CMA)

Hafnium ingots may be produced by the consumable melting procedure but some difficulty may be encountered. All ingots were contaminated by copper with the procedures used, and erratic arcs were noted. A full starter plate bolted to the crucible bottom with a hafnium stud was adopted to eliminate arcing problems and a vacuum was maintained throughout; the ingots were thus improved. The forging and rolling procedures described are satisfactory. (C21d, F22, F23; Hf)

127-C. Digestion and Filtration of Leached Zone in Pilot Plant. Gordon L. Dugger, J. B. Adams and Roger Bart. International Minerals and Chemical Corp. *U.S. Atomic Energy Commission,* RMO-2044, Feb. 28, 1955, 35 p.

Study of the recovery of three products, tri-uranium octa-oxide (U_3O_8), phosphoric anhydride (P_2O_5) and alumina (Al_2O_3) from the 200-mesh fraction of the leached zone in the Florida phosphate field. (C19n; U, Al)

128-C. The Preparation of Large-Diameter Zirconium Crystal Bar by the De Boer Process. H. H. Bulkowski, et al. *U.S. Atomic Energy Commission,* BMI-523, Mar. 6, 1951, 17 p. (CMA)

Work with a conventional, large-diameter de Boer apparatus has shown that zirconium crystal bar of large diameter may be produced. Bar averaging 1.62 in. diameter can be produced with a power consumption of 60-90 kw. per hr. per lb., slightly more than for bar of smaller diameter. The unit was constructed of Hastelloy B. (C28, 1-2; Zr)

129-C. Consumable Electrode Arc-Melting of Cold Compacted Thorium Powder. R. Witt. Sylvania Electric Products, Inc. *U.S. Atomic Energy Commission,* SEP-209, Apr. 19, 1956, 28 p.

The consumable-electrode arc melting of cold compacted thorium powder has been developed to produce dense, clean and soft ingots which can be hot rolled without cracking. The relationship of specific variables such as power at the arc, crucible size, electrode size and argon pressure have been determined relative to minimum requirements to obtain sound ingots. (C5h; Th, 6-23)

130-C. Hydrofluorination of Zirconium Oxide. Don Phillips. *U.S. Atomic Energy Commission,* AECD-4054, Aug. 2, 1950, 5 p. (CMA)

Calcium reduction of zirconium tetrafluoride has shown promise as an approach to pure ductile zirconium, and therefore the hydrofluorination of ZrO_2 to produce ZrF_4 was studied on a small scale. The sample for hydrofluorination must be free of carbon. A study of reaction time and temperature showed that at least 2 hr. at 700° C. is necessary. The most demanding conditions for complete reaction were 4 hr. at 800° C. The effect of adding hydrogen to the inert atmosphere employed is noted. (C1p; Zr)

131-C. Percolation Leaching of Manganese Ores With Sulfur Dioxide. F. N. Bender and Carl Rampacek. *U.S. Bureau of Mines,* Report of Investigations 5323, Mar. 1957, 20 p.

Percolation leaching of wad-type manganese ores was investigated, using a novel system of alternate upward passage of sulphur dioxide gas through moistened ore and downward percolation of wash solutions to extract solubilized manganese. (C19n; Mn, RM-n)

132-C. Titanium Sponge Production Methods and Present Status. J. L. Gissy, G. H. Schipperit and J. G. Kura. Battelle Memorial Institute. *U.S. Office of Technical Services,* Report 52. PB 121620, Sept. 1956, 32 p. (CMA)

Discussion of raw materials used in titanium sponge processing includes ores and the use of ilmenite. Chlorination, purification and reduction phases are covered, merits and demerits of the sodium reduction and Kroll processes are noted. A list of domestic and foreign producers is given. (C26; Ti, RM-n, 6-24)

133-C. (German.) High-Vacuum Smelting of Uranium. Heinz E. Schimmelbusch and Heimo Hardung-Hardung. *Atom Praxis,* v. 3, no. 1, 1957, p. 11-14.

Smelting in suitable crucibles, ingot casting at high vacuum; smelting in high-vacuum arc furnaces using self consuming uranium electrodes. (C25; U)

134-C. (German.) The Amalgam Metallurgy of Titanium. H. Hohm, E. Fitzer and H. Hofbauer. *Berg- und Huetenmannische Monatshefte,* v. 101, Dec. 1956, p. 277-285. (CMA)

The authors experimented with the possibilities of the reduction of titanium tetrachloride by amalgams and obtained results encouraging enough to envisage a procedure of continuous smelting of titanium sponge. The reaction mass is separated into two liquid phases: metal and a slag of salts. The latter is made sufficiently fluid by obtaining a eutectic composition through a just apportioning of the amalgams of sodium and calcium. The procedure consists of (1) the reaction between

$TiCl_4$ and $Ca_xHg + Na_xHg$, whereby $TiHg + Hg$ and the slag $NaCl + CaCl_2$ are formed; (2) filtration, whereby TiHg and Hg (90%) are separated; (3) distillation, when Hg (10%) is eliminated from the titanium sponge; and (4) recovery of sodium and calcium through the electrolysis of the chlorides. 16 ref. (C29; Ti)

135-C. Vacuum Melting and Annealing. Roger Giler. *Metal Treating*, v. 8, Mar-Apr. 1957, p. 14-16, 60.

Applications and benefits of vacuum treatment; furnace types. Vacuum induction melting, vacuum arc melting and vacuum heat treating. (C5h, C5j, I-23, D8m, J2n, 1-2)

136-C. How and Why of Pressure Leaching and Precipitation Processes. Frank A. Forward. *Mining Congress Journal*, v. 43, Apr. 1957, p. 112-116.

An appraisal of pressure hydrometallurgical processes which examines principles involved, potential applications, and the feasibility of conducting operations of this type successfully on a practical basis. (C19n, B14, 3-24)

137-C. Resin-in-Pulp Method for Recovery of Uranium. R. F. Hollis and C. K. McArthur. *Mining Engineering*, v. 9, Apr. 1957, p. 442-449.

Five U.S. commercial uranium ore-processing plants now in final design or under construction incorporate this process. Dissolved uranium is recovered from acid-leached pulps by strong base anion exchange resins. (C19s; U)

138-C. Purification of Mercury and Its Physical Properties. Charles L. Gordon and Edward Wichers. *New York Academy of Sciences, Annals*, v. 65, Apr. 11, 1957, p. 369-387.

Principal procedures that have been used for purifying mercury; recommendations of the modifications of these procedures that have been found most convenient and useful; review of suitable criteria of purity for the metal, and tabulation of values for most of its important physical properties. 59 ref. (C general, P general; Hg)

139-C. Homogeneous Alloy Ingots Produced by Consumable-Electrode Arc Melting. R. A. Beall, F. Caputo and E. T. Hayes. Bureau of Mines, Report of Investigations 5200. *U.S. Office of Technical Services*, PB 123755, Mar. 1956, 14 p. (CMA)

Homogeneous zirconium alloy ingots of high specifications were made by consumable electrode arc melting in water-cooled copper crucible. Zirconium alloy bars were pressed from sponge semi-continuously with periodic alloying addition. Magnetic stirring improved ingot homogeneity. Double melting is required for uniform alloy distribution and complete gas removal. Alloying additions in the form of tin wire in bars were unsuccessful. (C5h, C5r; Zr)

140-C. Electrochemical Preparation of Boron. Nelson F. Murphy, Richard S. Tinsley and George F. Meenaghan. *Virginia Polytechnic Institute, Bulletin*, v. 50, Feb. 1957, p. 3-18.

Electrolysis of the sodium oxide-sodium borofluoride-boron oxide molten salt bath at about 800 to 850° C.; 1.0 amp. per sq. cm. using iron cathode and graphite rod anodes is recommended as a new method for preparation of elemental boron. 26 ref. (C23p; B)

141-C. (German.) **Magnesium and Its Casting Alloys.** K. Sautner. *Metall*, v. 11, Mar. 1957, p. 196-201.

Occurrence; preparation by electrolysis of dehydrated carnallite, artificial (recrystallized) carnallite, synthetic carnallite, chlorination of magnesium oxide; preparation from sea water by precipitation with lime water or dolomite; other preparation methods, application of magnesium alloys. (C general, T general; Mg, 5)

142-C. (German.) **Formation Mechanism of Mercury-Free Alloys During Amalgam Reactions.** Franz Lihl and Herbert Kirnbauer. *Zeitschrift für Metallkunde*, v. 48, Feb. 1957, p. 61-66.

Amalgam process for the preparation of mercury-free alloys at temperatures between 200 and 400° C. Classification of amalgams and reactions under different conditions. Mechanism of alloy formation in mercury; thermodynamic equilibria of the mercury-free alloys and conditions for the application of the amalgam process. 2 ref. (C29)

143-C. (Italian.) **Electrolytic Refining of Lead in the Plant of S. Gavino Monreale.** E. Freni. *Metallurgia Italiana*, v. 49, Feb. 1957, p. 107-123.

Results obtained in a pilot plant (three tons daily capacity) allowed a direct comparison between the classic method and the new refining process with full advantage for the latter, particularly when bismuth-bearing lead is treated. 22 ref. (C23p; Pb)

144-C. (Italian.) **Fluoride-Chloride Baths for Electrolysis of Alumina.** A. Vajna. *Metallurgia Italiana*, v. 49, Feb. 1957, p. 124-126.

Investigation of some chemical and physical properties of fluoride-chloride baths for the electrolysis of alumina with regard to their possible application in industrial cells of conventional type. 3 ref. (C23p; Al)

D Iron and Steelmaking

104-D. History of the Tropenas Process. *Australasian Manufacturer*, v. 41, Feb. 23, 1957, p. 76-101.

The Tropenas process in use today in many steel foundries is an improvement upon the bessemer process of steel manufacture. One of the drawbacks of the bessemer process was heavy air pressure required to force the blast right through the body of the bath from bottom to surface, and the difficulty of keeping the metal hot enough during the process of casting. In the Tropenas method the tuyeres for the introduction of air blast set up a rotary motion to the bath and bring about a more rapid and complete purification and conversion of iron into steel. (D3f; ST)

105-D. Russian Blast Furnace Practice. *Foundry Trade Journal*, v. 102, Feb. 21, 1957, p. 247-248.

Use in the U.S.S.R. of wet blast at constant humidity and application of high top pressure; top pressure increases blast furnace productivity. High top pressure minimizes gas cleaning problems. (D1h)

106-D. Rotor Steelmaking Process; Control, Heat Balance, and Economics. R. Graef. *Iron and Coal Trades Review*, v. 174, Feb. 22, 1957, p. 437-460.

The rotor process of steelmaking is a conversion technique in which blast furnace metal is charged to a long cylindrical kiln, which revolves slowly on its own axis, and is converted to steel by the action of nearly pure gaseous oxygen. A particular feature of the process is the system of control based on the carbon monoxide content of waste gases. (D10; ST)

107-D. Combustion and Heat Transfer in an Open-Hearth Furnace. J. H. Chesters. *Iron and Coal Trades Review*, v. 174, Mar. 8, 1957, p. 553-562.

Initial objective was a comparison of calculated and actual heat transfer, but the trials soon took on a broader aspect and were followed by a number of more specialized studies, e.g., on the effect of burner position on iron oxide deposition. (D2h)

108-D. Sponge Iron in Electric Arc Furnaces. John L. Stalhed. *Journal of Metals*, v. 9, Feb. 1957, p. 246-249.

About 22% of Sweden's steel production is high-grade steels which are today made in electric furnaces; Sweden utilizes a greater tonnage of sponge iron than any other country; so far, it is used only for high-grade steel. Technique and advantages of sponge iron and justification for its use, although costlier than scrap. 7 ref. (D5; Fe, 6-24)

109-D. Reduction of Iron Ores. Possibilities of an Alternative to the Blast Furnace. S. G. Cope. *Murex Review*, v. 1, no. 17, 1957, p. 465-497.

Comprehensive review of attempts to find workable alternative to blast furnace; covers limitations of blast furnace and possibilities of electric smelting, low shaft and rotary furnaces for producing pig iron; direct reduction processes employing solid reducing agents including retort, shaft and rotary furnace processes and direct reduction processes involving reduction by gases including shaft, rotary kiln, multiple-hearth, bubble-hearth and other processes. 42 ref. (D1, D8; Fe)

110-D. (French.) **Use of the Electric Furnace in the Reduction of Iron Ores.** *Journal du Four Eléctrique*, no. 6, Nov-Dec. 1956, p. 217-219.

Increasingly high cost of coke is concentrating attention on the electrothermic reduction of iron ore; comparison of costs of production using the classic blast furnace and the electric furnace; general discussion of both processes. (D8n, D1, 17-3; Fe, RM-n)

111-D. (German.) **Steel Production According to the LD Method.** J. Eibl. *Osterreichische Zeitschrift für Elektrizitatswirtschaft*, v. 9, Dec. 1956, p. 551-555.

Description of the LD process—production of steel through oxygen top blowing in a converter-shaped crucible. (D10a, ST)

112-D. (Russian.) **On the Application of Radioactive Isotopes in Metallurgy.** E. Belyakova. *Atomnaya Energiya*, no. 5, Sept-Oct. 1956, p. 151-152.

Kinetics of dephosphorization and desulphurization by slags; distribution of alloying elements in open-hearth furnaces of various capacities; penetration of hot-top material into the body of an ingot; sources of contamination of ball bearing steel; liquation phenomena in steel ingots; diffusion along the grain boundary. (D11, N1; ST, 14-13)

113-D. Optimize Combustion Control on Open-Hearth Furnaces. F. S. Swaney. *Control Engineering*, Apr. 1957, p. 123-125.

Ordinary fuel-air ratio control systems can be improved by controlling combustion air according to the percentage of unburned oxygen among the waste gases. Here is a system that uses this measurement to regulate the fuel-air controller. (D2h)

114-D. Further Considerations on High-Alumina Blast Furnace Slags. H. Schrader and P. Mehra. *Indian Institute of Metals, Transactions,* v. 8, 1954-55, p. 61-79.

The problems in blast-furnace operation due to the beneficiation of raw materials and the resulting increase in alumina content of blast-furnace slag are discussed. Fluidity measurements on high-alumina slag in both the acid and basic range of lime-silica ratio were carried out. The effect of titania additions of the fluidity of high-alumina blast-furnace slags was also studied. The influence of lime, alumina, silica and magnesia additions singly and in the combined state in blast-furnace slag were studied from the viewpoint of microstructure. 19 ref. (D1g; RM-q, *Al*)

115-D. Recovery of Manganese From Steelmaking and Blast-Furnace Ferromanganese Slags. N. J. Wadia, S. Visvanathan and V. G. Paranjpe. *Indian Institute of Metals, Transactions,* v. 8, 1954-55, p. 81-108.

Since ferromanganese slags produced in the blast furnace and low-shaft furnace contain appreciable amounts of manganese, methods of recovering this valuable metal from the slags by reduction were studied. Reducing agents like ferrosilicon, aluminum and aluminum-silicon alloys were used and products like ferromanganese, silicomanganese and 'Simanal' were obtained. 15 ref. (D1g; RM-q, AD-a, Fe, Mn)

116-D. Desulphurization of Steel by Soda Ash Treatment. N. J. Wadia, V. G. Paranjpe and S. Visvanathan. *Indian Institute of Metals, Transactions,* v. 8, 1954-55, p. 109-116.

Soda ash was used as a desulphurizing agent for liquid steel. Melts of low-carbon steel, with varying degrees of deoxidation, and of high-silicon steel were employed in this work. The results have been reviewed along with earlier work on soda slags and it has been shown that the oxygen potential under conditions of treatment influences the extent of desulphurization. 11 ref. (D11f; ST, AD-a)

117-D. Studies on the Oxidation of Phosphorus in Indian Pig Iron With Enriched Air. G. P. Chatterjee. *Indian Institute of Metals, Transactions,* v. 8, 1954-55, p. 117-127.

An attempt is made to show that the phosphorus content can be effectively reduced by top-blowing with enriched air blast. Some of the fundamental thermodynamic considerations on dephosphorization and the importance of the rate of rise of temperature under a given slag condition. Whether or not such a process can be made industrially successful depends on other factors. (D3f, D11n; ST)

118-D. "Rotor" Process of Steelmaking. Rudolph Graef. *Iron and Coal Trades Review,* v. 174, Jan. 25, 1957, p. 213-216. Extract from *Stahl und Eisen,* v. 77, Jan. 10, 1957, p. 1-10.

Previously abstracted from original. See item 93-D, 1957. (D10; ST)

119-D. Continuous Casting Comes to Carbon Steel. *Steel,* v. 140, Mar. 25, 1957, p. 108-114.

Possible development of volume production; list of continuous casting machines for steel in U.S. and abroad with information on date operation started; amount produced and types of steel cast. (D9q; CN)

120-D. (German.) On the Hydrogen Content of Steel. L. M. Jefimow. *Neue Hütte,* v. 2, Jan. 1957, p. 13-17.

Attempts to reduce the hydrogen content of steel; method for determination of hydrogen content; influence of blast moisture on the hydrogen content. Addition of oxygen to the combustion air of open-hearth furnaces and its effect on hydrogen content and susceptibility to flaking of rail steel. 8 ref. (D11h; ST, H, 9-20)

121-D. Steel Production Today. R. L. Knight. *Australian Institute of Metals, Journal,* v. 1, Oct. 1956, p. 76-88.

Brief survey of various commercial steelmaking processes with emphasis on recent advances in design, technique and operation including oxygen converter process, open-hearth, electric arc, bessemer and Thomas processes and continuous casting. (D general)

122-D. Improvements in the Quality of Silica Roof-Bricks—Pt. 9. W. M. Fern. *British Ceramic Society, Transactions,* v. 56, Mar. 1957, p. 110-132.

Trends in chemical and physical properties of silica roof blocks. Changing from high to low-alumina silica openhearth roof blocks resulted in roof lives increasing by about 100% despite higher steel production rates. However, the advantages of improved refractories can only be realized under severe operating conditions. (D2; RM-h36)

123-D. Oxygen for Steelmaking. *Industrial Chemist,* v. 32, Oct. 1956, p. 424-425.

The use of oxygen in a number of steelmaking operations can increase output by 15 to 25%. This increase can be obtained at about 1/10 the capital cost of additional steelmaking equipment. (D general; ST, O)

124-D. Fuel and Energy Requirements of the Steel Industry. W. H. Brook. *Institute of Fuel, Journal,* v. 29, Nov. 1956, p. 465-471.

The reduction of ore to steel is considered as taking place in three principal stages: (1) reduction of ore to pig iron in the blast furnace, (2) conversion of pig iron to steel ingots in the openhearth furnace, and (3) mechanical deformation of steel ingots in rolling mills to produce bars, plates, sheets, strip and other marketable products. (D general, 16)

125-D. New Process Puts Higher Profit in Low Grade Ores. *Iron Age,* v. 179, Apr. 4, 1957, p. 102-103.

Udy process employing selective reductions in electric furnace stages promises economic recovery of ferromanganese and iron from low-grade manganese ores. (D5; Fe, Mn, AD-n)

126-D. Future of the Steel Industry. *New Scientist,* Mar. 8, 1957, p. 9-11.

Plans to meet rapidly increasing demands from industry by installing new plant and improving old. Most significant is the use of cheap oxygen in steel furnaces. (D general, W10; O)

127-D. Russian Development in Steel Casting. Tom Margerison. *New Scientist,* Mar. 28, 1957, p. 29-31.

Continuous casting in Russian steel industry. (D9q; ST)

128-D. Investigation of the Desulphurization of Pig Iron With Sodium Carbonate. O. V. Travin and L. A. Shvartsman. *Henry Brutcher Translation* no. 3865, 9 p. (From *Izvestiya Akademii Nauk SSSR,* no. 12, Dec. 1953, p. 1804-1812.) Henry Brutcher, Altadena, Calif.

Laboratory study of desulphurization of carbon-saturated iron with sodium carbonate; based on use of radioactive isotope of sulphur to establish the mechanism and the regularities of the process and to find the most efficient method of employing sodium carbonate. (D11s; Fe, AD-a)

129-D. Use of Radioactive Calcium for Studying the Contamination of Steel by Refractory Particles During Pouring. O. M. Margulis and A. G. Karaulov. *Henry Brutcher Translation* no. 3849, 6 p. (From *Ogneupory,* v. 21, no. 6, 1956, p. 253-258.) Henry Brutcher, Altadena, Calif.

Proportions of material derived from the refractories in the ladle linings, spout linings and bottom-pouring assemblies among the total nonmetallic inclusion content of steel determined by radiometric measurements with Ca^{45}. (D9p; ST, RM-h, Ca, 14-13)

130-D. Experiments on Increasing the Capacity of Continuous Casting Molds for Steel. K. G. Speith and A. Bungeroth. *Henry Brutcher Translation* no. 3871, 15 p. (From *Forschungsberichte,* no. 234, 1956, p. 1-15.) Henry Brutcher, Altadena, Calif.

Study of possibilities of increasing the mold productivity (capacity) in continuous casting machines for individual molds. Effect of different mold tapers (0.5, 1 and 2%) upon maximum permissible casting speed. (D9q, 1-2; ST)

131-D. Melting of High-Purity Iron by the Carbon Reduction Process and Notch Toughness Versus Temperature Curves of This Iron. W. A. Fischer, H. Treppschuh and K. H. Köthemann. *Henry Brutcher Translation* no. 3877, 6 p. (From *Archiv Eisenhüttenwesen,* v. 27, no. 9, 1956, p. 567-572.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 372-D, 1956. (D general, Q6, Fe)

132-D. A Special Type of Ingot Crack Resulting From Certain Impurities in Steel. P. Björnson and H. Nathorst. *Henry Brutcher Translation* no. 3880, 17 p. (From *Jernkontorets Annaler,* v. 139, 1955, p. 422-438.) Henry Brutcher, Altadena, Calif.

Study of longitudinal cracks in 0.30, 0.70, and 0.80% C basic arc furnace steel ingots caused by residual copper and tin. (D11s; ST, 9-22, 5-9, Cu, *Sn*)

133-D. Vacuum Melting of Steels and Other Iron-Base Alloys. H. Zakowa. *Henry Brutcher Translation* no. 3890, 8 p. (From *Prace IMH,* v. v. 76, no. 26, 1956, p. 1721.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 402-D, 1956. (D8, ST)

134-D. Oxidation of Manganese Dissolved in Liquid Iron. B. V. Linchevskii and A. M. Samarin. *Henry Brutcher Translation* no. 3893, 3 p. (From *Doklady Akademii Nauk SSSR,* v. 110, no. 2, 1956, p. 209-211.) Henry Brutcher, Altadena, Calif.

Need for data on the formation and composition of products from oxidation reactions of manganese in

solution in liquid iron, for improved techniques of deoxidizing steel with manganese. Confirmation of results by study of nonmetallic inclusions. (D11r; Fe, Mn, AD-r)

135-D. Reduced-Pressure Treatment of Molten Steel on Plant Scale. F. Harders, H. Knüppell and K. Brotzmann. *Henry Brutcher Translation* no. 3900, 8 p. (From *Stahl und Eisen*, v. 76, no. 26, 1956, p. 1721-1728.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 60-D, 1957. (D8m; ST)

136-D. (English.) **Rapid Metallurgy (Ugine-Perrin Process).** *Aciers Fins & Speciaux*, no. 25, Mar. 1957, p. 51-54.

Advantages of the process are rapidity, consistency in results and the promotion of high-speed completed reactions between metal and slag. Applications to steelmaking—deoxidation and desulphurization of steel, over-oxidized converter steels. Process has also been applied in the refining of very low-carbon ferrochrome and over-refined ferromanganese. Costs.
(D5; ST, AD-n, Cr, Mn)

137-D. (English.) **Eastern High-Grade Steels Company at Hagondange, Moselle.** *Aciers Fins & Speciaux*, no. 25, Mar. 1957, p. 107-110.

Activities of the Societe des Aciers Fins de l'Est. Operations fall under two distinct headings: steelwork and forging shop for high-grade and special electric steels; and plate works for sheets and medium and heavy plates of all kinds. Equipment employed and range of products.
(D general, F22, F23; ST, AY)

138-D. (French.) **Recent Progress in Iron Ore Reduction Processes.** Paul Thierry. *Metallurgie et la Construction Mecanique*, v. 89, Mar. 1957, p. 207-217.

Improved efficiency of blast furnaces; increased production per unit; improved quality of pig iron; enumeration and description of processes which do not use furnace coke. (D1h, D8; Fe)

139-D. (German.) **Chemical Equilibria in the Thomas Converter.** Alfred Decker. *Archiv für das Eisenhüttenwesen*, v. 28, Feb. 1957, p. 57-64.

Development of a procedure for the fairly exact calculation of the manganese, oxygen, phosphorus and sulphur content of the Thomas melt at the end of the smelting. 12 ref. (D3, D11s; ST)

140-D. (German.) **Operational Results in Basic Converter Steel Plant Using Limestone in Small Lumps. Pt. 2.** Alfred Latour and Leo Heinen. *Stahl und Eisen*, v. 77, Apr. 4, 1957, p. 426-428.

Results of operation of 60 basic converter heats using small lump lime from the Volklingen-type crossflow shaft kiln. (D3, 1-15; ST, NM-e)

141-D. (German.) **High-Vacuum Methods in Metallurgy.** Werner Scheibe. *Zeitschrift für Metallkunde*, v. 48, Mar. 1957, p. 91-100.

Melting, sintering and annealing in high vacuum; influence of oxygen, nitrogen, hydrogen and carbon on the strength properties of unalloyed and alloyed steels; magnetic properties of iron alloys. 17 ref. (D8m, H15, J23, I-23; Q27a, P16; ST, Fe)

142-D. (Portuguese.) **Selection of Carbon Steel Ingots. Pt. I.** Waldemar de Lima e Silva. *Engenharia, Mineracao e Metalurgia*, v. 25, Jan. 1957, p. 31-32.

Types of furnaces used; AISI and SAE classification; effects of carbon, manganese, phosphorus, sulphur and silicon. (To be continued.) (D9, 1-2, 1-10; ST)

143-D. (Russian.) **Investigation of Heat Exchange and Reduction Processes During Work on a Fluxing Agglomerate.** N. N. Babarykin and F. A. Ushin. *Stal'*, v. 17, Jan. 1957, p. 7-15.

During the transition of hot fluxing agglomerates, the temperature of the charge and of gas in the upper part of the blast furnace rises. Maximum speed of reduction occurs in the upper and lower parts of the charge column. 3 ref.
(D1, D11n; Fe)

E Foundry

129-E. Shrinkage Defects in K-Bar Test Castings. J. Gittus. *British Cast Iron Research Association Journal*, v. 6, Feb. 1957, p. 456-483.

Experimental study of factors believed to have influence on shrinkage defects in iron castings; mathematical analysis of simultaneous effects on surface shrinkage of maximum temperature, pouring temperature, time interval, carbon, silicon, manganese, sulphur and phosphorus content of castings and shatter index of sand; influence of melting temperature, pouring temperature, inoculation with ferrosilicon and analysis on shrinkage defects; influence of mold produced by carbon dioxide process and effects of oxygen on shrinkage defects.
(E25n; CI, 9)

130-E. Speedier Production of Cylinder Liners. Harold W. Haynes. *Castings*, v. 3, Feb. 1957, p. 23-27.

Compares hand and machine ramming of cores used in casting cylinder liners. In this case hand ramming proved economical. (E22s)

131-E. Advantages of Cast Parts. W. Peppler. *Foundry Trade Journal*, v. 102, Feb. 14, 1957, p. 203-206.

Historical development of metal founding, followed by a comparison between cast and welded construction. Freedom of design in shaping castings is cited as one of the major advantages of the former.
(E general, 17-1)

132-E. Automatic "Buehrer" Moulding and Pouring Plant in the Malleable-Iron Foundry of George Fischer, Limited. *Foundry Trade Journal*, v. 102, Feb. 21, 1957, p. 233-238.

Operations in a pilot plant for jobbing foundry with automatic molding and casting equipment. Details sand selection, molding and pouring practices. (E11, 18-24; CI-s)

133-E. Origin of Graphite in Cast Irons. J. E. Harris and V. Kondic. *Foundry Trade Journal*, v. 102, Feb. 28, 1957, p. 267-277.

Includes brief review of literature, reports of reheating experiments, kinetic studies and quenching tests made to determine whether graphite is formed directly from the melt or on decomposition of iron carbide during or after solidification. 15 ref. (To be continued.) (E25n; CI)

134-E. Art of Hand Ramming; or Moulds 'Through the Looking Glass'? Jaques. *Foundry Trade Journal*, v. 102, Feb. 28, 1957, p. 283-284.

Training hints for hand ramming of sand molds. Glass-sided molding box suggested for use in demonstrations. (E19)

135-E. We Owe Our Success to CO_2. Hans Jacob. *Modern Castings*, v. 31, Mar. 1957, p. 32-33.

Unusual strength of CO_2-hardened molds permits the casting of cartridges in the vertical position using a minimum of flask equipment.
(E19, E17)

136-E. Graphite Spray Speeds Die Casting. *Modern Castings*, v. 31, Mar. 1957, p. 36.

Reduces surface and internal defects while increasing die life.
(E13, NM-k36)

137-E. Cooling Hot Shot for Shell Backing. A. J. Hall. *Modern Castings*, v. 31, Mar. 1957, p. 58-59.

Screened and air cooled shot eliminates safety hazards and high costs which have held back the use of shot as a backing material for shell molding. (E19c)

138-E. Sprue Spreader and Sprue Bushing Design. Folke Halward. *Precision Metal Molding*, v. 15, Mar. 1957, p. 49-52.

Current American practice. Success or failure of a die-casting die may be determined by the design and cooling of sprue spreaders and bushings. (E13, 17-1)

139-E. A Shell-Core in a Sand Mold. *Precision Metal Molding*, v. 15, Mar. 1957, p. 53-54.

Cooper Alloy Corp., Hillside, N.J., has recently demonstrated that the combination of green sand mold with a shell molded core enables the casting of large parts to small tolerances without subsequent machining. (E19c; SS)

140-E. (French.) **Sulzer Precision Casting.** Walter Sulzer. *Métaux-Corrosion-Industries*, v. 32, Feb. 1957, p. 79-90.

Two processes applied in precision casting, the lost wax process and the "G" process; equipment, techniques, tolerances, economic considerations, machining, applications. (E15)

141-E. (German.) **Measurement and Control of Cupolas.** Walter Ruppert. *Giesserei*, v. 44, Mar. 7, 1957, p. 153-160.

Measurement of the volume and pressure of the wind; humidity of the wind; analysis of the throat gas; temperature of the melt; control of the wind volume; hot blast cupola; cupolas with the blast heated by the heat of the throat gas and by combustion of throat gas as well as of gases of other origin. (E10a)

142-E. (German.) **The Dividing Core Process.** R. Schmidt. *Giessereitechnik*, v. 3, Jan. 1957, p. 3-6.

Loss of time and money by removal of gates and heads. Separation by oxy-acetylene cutting or cutting by grinding wheel. Disadvantages of these methods. Requirements for separating core. Examples for applications. (E22s, E21)

143-E. (German.) **Contribution to the Waterglass Mold Procedure.** Siegfried Böhmer. *Giessereitechnik*, v. 3, Jan. 1957, p. 6-9.

Use of sodium waterglass as a molding material and as a core binder. Hardening by reaction of the waterglass with carbon dioxide. $Na_2SiO_3 + CO_2 = Na_2CO_3 + SiO_2$ Description of the hardening mech-

anism of the waterglass. Hardening with ammonia. 14 ref. (E19, E21)

144-E. (German.) **Manufacture of Wooden Patterns for Ships' Propellers.** Paul Kolawski. *Giessereitechnik,* v. 3, Jan. 1957, p. 12-13.

Various techniques in different shops, and necessity of finding the most economical one. Tracing of pitch, calculation of pitch at 10 and 5° respectively. Tracing of beam on wooden slab, cutting and assembly. (E17)

145-E. Practical pH Control for Moulding Sand. Edward C. Zuppann. *Foundry,* v. 85, Apr. 1957, p. 106-110.

Control of pH in molding sands; results to be expected; effect of pH on casting quality and defects. (E18)

146-E. Design of Gray Iron Castings. Arthur Scharf and Charles F. Walton. *Foundry,* v. 85, Apr. 1957, p. 111-115.

Consideration of design factors, of primary concern to foundrymen, which facilitate molding, coring, and pouring and minimize defects and costs. (E11, 17-1; CI-n)

147-E. Cleaning Costs Are Affected by What You Do to a Mold. Hubert Chappie. *Foundry,* v. 85, Apr. 1957, p. 116-121.

Precautions to observe in removing cope, drawing pattern, cutting gate, in application of wash, mold drying for pouring for large steel castings. (E11; ST)

148-E. Steel Foundry Shows Scrap Can Be Reduced. Robert H. Herrmann. *Foundry,* v. 85, Apr. 1957, p. 122-127.

Melting, molding, coring, pouring, cleaning and inspection equipment and procedures used in carefully managed steel foundry. (E general; ST)

149-E. Coremaking Practices in the Brass Foundry. Harry St. John. *Foundry,* v. 85, Apr. 1957, p. 128-131.

Production and mixing methods; advantages and limitations of dielectric core baking and the possibility of shell and carbon dioxide hardened cores. (E21; Cu-n)

150-E. Shell Cores Made by New Automatic Machine. George B. Schueler. *Foundry,* v. 85, Apr. 1957, p. 242-245.

Automatic machine using principle similar to that used for injection molding of plastics; can blow variety of good quality shell cores. (E19c, 1-2)

151-E. Line Production of Pressure Die-Castings. *Foundry Trade Journal,* v. 102, Mar. 21, 1957, p. 353-359.

Plant layout, melting, die-casting, conveying and trimming equipment and operations in an English firm. (E13, 1-2)

152-E. Investment 'X' Castings. *Materials and Methods,* v. 45, Mar. 1957, p. 124-125.

Advantages of process in which wax pattern assembly is invested with several coats and wax removed by immersion and trichloroethylene vapor. (E15)

153-E. Hardening Cement Molds With CO_2. *Modern Castings,* v. 31, Apr. 1957, p. 55-56.

Dutch technique of using CO_2 gas accelerates binding action of cement bonded cores and molds; allows removal of core boxes within a matter of minutes. (E19, E21)

154-E. Vibrating Strength Into Metals. A. H. Freedman and J. F. Wallace. *Modern Castings,* v. 31, Apr. 1957, p. 64-74.

Study of the effect of 60-cycle or 20-kilocycle vibration on the structure and tensile properties when applied to solidifying melts of various aluminum and copper-base alloys; grain refinement and strength improvement occur in alloys that solidify as single-phase solid solutions; hypothesis to explain mechanism of the effect of vibration. (E25n; Al, Cu)

155-E. Production of Titanium Shaped Castings. R. M. Lang, G. H. Schippereit and J. G. Kura. Battelle Memorial Institute. *U.S. Office of Technical Services,* Report 60, PB 121604, Dec. 1956, 46 p. (CMA)

Melting furnaces, mold materials and casting alloys of titanium described. Since no suitable way of measuring melt temperature at pouring has been found, the superheat was measured indirectly by the power consumed after the metal becomes molten. Cast alloys thus far have strengths comparable to wrought forms, but ductility is lower. (E10, Q27a; Ti)

156-E. (German.) **Vacuum Melted Nickel for Electron Tubes.** Gerhard Pupke. *Neue Hütte,* v. 2, Jan. 1957, p. 35-39.

Melting in vacuum. Control of vacuum melting of nickel alloys with small deoxidizing additions; crucible problems; metallographic studies of grain boundary substances. (C5, 1-23; Ti; Ni)

157-E. (Italian.) **Hot Deformability of Sands Bonded With Self-Hardening Oils.** Rinaldo Cattanoe. *Fonderia,* v. 6, Feb. 1957, p. 55-57.

Lack of rigidity of sands can be largely controlled by use of oil of low thermosensitivity and additives, at least in sizes of cores studied. (E18r)

158-E. What the Engineer Expects From a Casting. L. B. Knoll. *Engineer and Foundryman,* v. 21, Mar. 1957, p. 56-62.

Size, shape, machinability, fettling and surface finish of castings. (E25, G17k)

159-E. The Carbon-Dioxide Process of Mould and Core Production. (Pt. 2) G. E. Parramore. *Foundry Trade Journal,* v. 102, Mar. 21, 1957, p. 361-365.

Method of core manufacture and indication of variety that can be produced by process; surface finish of castings, collapsibility of sand after casting, sand reclamation, carbon dioxide supply and economy made possible. (E21, E11)

160-E. Elevated-Temperature Testing of Moulding and Core Sands and Correlation With Casting Quality. Harry W. Dietert, V. M. Rowell and A. L. Graham. *Foundry Trade Journal,* v. 102, Mar. 28, 1957, p. 379-388.

Relationship between elevated-temperature properties of sand and failure of mold surfaces including cuts, washes, rat-tails, buckles, expansion and erosion-type scabs; description of procedure and equipment for tests of hot compression strength, hot deformation and expansion properties of mold sand. (E18r)

161-E. Dextrose Binder Speeds Core Production. C. F. Lourich. *Iron Age,* v. 179, Apr. 4, 1957, p. 104-105.

Cores made with Dexocor baked in 40 to 50% less time are harder and stand up better than cores made with conventional core binders. (E21)

162-E. Titanium-CO_2 Process for Cast Iron. J. V. Dawson, B. B. Bach and L. W. L. Smith. *Metal Progress,* v. 71, no. 4, Apr. 1957, p. 174, 176. (Digest from *Journal of Research and Development,* British Cast Iron Research Association, v. 6, June 1956, p. 249-258.) (CMA)

Adding titanium to gray cast iron refines the graphite structure; bubbling a dry, inert gas such as CO_2 or argon through the iron also enhances refining by lowering the hydrogen content. Up to 0.25% titanium was added. (E25q; CI-n, Ti, AD-p)

163-E. Research on Shell Molding. Massachusetts Institute of Technology (Frankford Arsenal). *U.S. Office of Technical Services,* PB 121031, May 1953, 54 p. $1.50.

Economy measures were sought through a study of means for making suitable shells with a minimum of phenolic resin. Recommendations for conservation are based on such practices as increased scientific control of variables such as grain size and distribution of sand and resin, particle packing and surface preparation of sand. Knowledge of the binding mechanism was gained through evaluation of various brands of resins by strength tests on shell specimens. (E19c)

164-E. (Czech.) **Experiments on Oxygen Enrichment of the Blast for Cupolas.** M. Vilgus and B. Otohal. *Henry Brutcher Translation* no. 3889, 5 p. (From *Slévarenstvi,* v. 2, no. 10, 1956, p. 292-296.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 59-E, 1955. (E10)

165-E. (French.) **Preheating of Casting Ladles.** *Journal d'Informations Techniques des Industries de la Fonderie,* no. 84, Feb. 1957, p. 4-6.

Preheating reduces caloric loss to a significant degree; moreover, in many cases, a sufficiently high casting temperature lowers the incidence of rejects. It is claimed that it is better to heat the ladles rather than the ingots. Calculation of production costs in relation to cost of fuel used and heat conserved by each technique. (E10, E25n)

166-E. (French.) **Benefit Derived From the Preheating of Molds in Casting Under Pressure.** *Journal d'Informations Techniques des Industries de la Fonderie,* no. 84, Feb. 1957, p. 7-8.

Preheating avoids equipment damage by suppressing over-violent heat shock and reduces unfavorable results such as cold shuts; factors determining the heat necessary for the casting of various metals; information of cracks; methods of preheating. (E19)

167-E. (French.) **Die Casting—Some Factors Influencing the Rate of Production.** H. K. Barton. *Machine Moderne et Revue Mecanique,* no. 577, Apr. 1957, p. 61-66.

Further features involved in the casting process; analysis and description. (E13, 17-2)

168-E. (German.) **Set-Up Time Per Piece in Hand Molding, Core Making and Fettling of Castings.** Friedrick Lamm. *Giesserei,* v. 44, no. 8, Apr. 11, 1957, p. 202-205.

Significance of the set-up time per piece in the calculation of prices; possibilities of improving upon the set-up time; investigation of the set-up time according to work processes. (E19, E21, A5)

169-E. (German.) **Volume Change of Metals on Solidification.** R. Doma-

nowski. *Giesserei-Praxis,* v. 75, Feb. 25, 1957, p. 77-80; Mar. 10, 1957, p. 100-104.

Methods of solidification, causes of volume changes and preventive measures for obtaining minimum shrinkage. 4 ref. (E25n, P10d)

170-E. (German.) **Shrinkage and Contraction in Steel Castings.** Sirius. *Giesserei-Praxis,* v. 75, Mar. 25, 1957, p. 113-115.

Prevention of internal shrinkage through the use of risers. (E22q, P10d)

171-E. (German.) **Casting of Highly Conductive Copper.** Ernst Brunhuber. *Giesserei-Praxis,* v. 75, Mar. 25, 1957, p. 115-117.

Importance of deoxidizers; melting furnaces; methods of casting. 4 ref. (E10, E11; Cu, AD-r)

172-E. (German.) **Influence of the Casting Temperature and of Alloying Metals Upon the Structure of the Casting.** F. Lihl and T. Sagoschen. *Metall,* v. 11, Mar. 1957, p. 179-189.

A fine crystalline structure in aluminum alloys can be obtained by: (1) choice of a casting temperature slightly above melting point; (2) addition of alloying metals which reduce the grain size, and (3) suitable choice of solidification conditions and mechanical treatment of the melt in the region of the solidification temperature. 32 ref. (E25n, M27; Al)

173-E. (Book—Finnish.) **CO_2 Process in the Foundry.** Paauo Asanti and Aarne Raikka. Finnish State Institute for Technical Research. (Metallurgical Report Series 2-1 Tiedotus, Sarjall-Metalli.1.) 1956, 1116 p.

Investigation of the CO_2 process with a description of the characteristics of sands for molds and cores. Waterglass is found to impart good properties to the sand mix. For high-alloy steel castings, the use of a blackwash containing zirconia and chromium ore powder is recommended. 35 ref. (E18p)

174-E. (Book—German.) **Modern Foundries.** A. Schulenburg. 424 p. 1955. Fachverlag Schiele and Schön Bopp Strasse 10, Berlin SW 29, Germany. DM 28.

Technical and organizational prerequisites for modern foundry operation. Topics discussed are plant and efficient area utilization; technical and mechanical facilities; modern molding and pouring methods; plant organization and working methods. (E general, W10)

175-E. (Book—German.) **Calculations and Tables for Foundry Personnel.** Gerhart Tschorn. 214 p. 1957. VEB Wilhelm Knapp Verlag, Mühlweg 19, Halle (Saale), C2, Germany. DM 16.

Calculation of strength of materials, weight of castings, pyrometry and teeming; operating characteristics of foundry equipment; metallographic and metallurgical calculations. (E general)

F Primary Mechanical Working

76-F. Manufacture of Electrically Resistance Welded Steel Tube. W. G. Jones. *Australasian Engineer,* no. 44, Jan. 7, 1957, p. 63-66.

The strip is edge-trimmed, formed, welded, sized, straightened and cut off in a continuous process. The raw material is hot rolled or cold rolled strip. (F26p, K3; ST)

77-F. Wire Flattening. A. Ball. *Draht* (English Edition), no. 27, Feb. 1957, p. 11-16.

Specifications, raw material and considerations for rolling, including contact arc and drafting; spread, skidding, roll surface wear, examples of continuous rolling, rolling heat, rolling load, drive, guides, material take-off and production planning. (F29s; ST, 4-11)

78-F. Preheating of Titanium. E. T. Adams. *Light Metals,* v. 20, Mar. 1957, p. 88-90. (CMA)

Furnace atmospheres for preheating titanium can contain some oxygen and nitrogen if the temperature does not exceed 800° C., since the diffusion rate is slow. Hydrogen diffuses rapidly but depends on the partial pressure, and under oxidizing conditions it absorbs slowly. The lowest temperature feasible should be used. Electric furnaces are preferred to gas or oil-fired furnaces but all may be preheated for hot working. (F21b, J2k; Ti)

79-F. (Portuguese.) **Basic Factors in the Problem of Rolling Steel in Latin America.** E. de Macedo Soares e Silva. *ABM, Bulletin of Brazilian Metals Society,* v. 12, Oct. 1956, p. 317-330.

Problems of design and installation of modern rolling equipment in integrated plants, in view of high productivity of blooming mills and continuous rolling mills. Suggests advisability, given rapid growth of markets, of making larger initial investments than absolutely necessary to permit future expansion. (F23, 1-2, 17-1; ST)

80-F. Induction Heating for Hot Pressing Non-Ferrous Metal Watch Cases. *Machinery,* v. 90, Mar. 22, 1957, p. 641-643.

Advantages of radio-frequency induction heating equipment for heating brass blanks prior to pressing. (F21b, J2g; Cu-n)

81-F. Hot Forged Parts. John L. Everhart. *Materials and Methods,* v. 45, Mar. 1957, p. 135-154.

Review of operations in the production of open and closed die forgings including information on forging design and tolerances to be expected. Numerous forged parts are used to illustrate forgings from iron, steel, aluminum, magnesium and titanium. (F22, 17-1, 17-5)

82-F. Hot Extrusion of Titanium and Titanium Alloys. A. M. Sabroff and P. D. Frost. Battelle Memorial Institute. *U.S. Office of Technical Services,* Report 53, PB 121621, Sept. 1956, 80 p. (CMA)

Results of a literature survey on the extrusion practices for titanium and its alloys. Requirements of the extrusions used by the aircraft industry. Problems in tooling, billet heating and lubrication. Mechanical properties of titanium extrusions. (F24, T24; Ti)

83-F. (German.) **General Conditions for the Compression Working of Titanium and Its Alloys.** Ig. M. Pawlow. *Berg- und Huettemaennische Monatshefte,* v. 101, Dec. 1956, p. 300-304. (CMA)

The characteristics of titanium and its alloys that have to be considered in compression working are the polymorphism of titanium (alpha and beta modifications) and its chemical activity at high temperatures (gas absorption, oxidation). General procedures for such operations as rolling and forming, based on these considerations, are discussed in some detail. (F general, G general; Ti)

84-F. (Italian.) **Considerations on the Use of Phosphatization in Tube Drawing.** Paolo de Cerma. *Rivista di Ingegneria,* v. 7, Jan. 1957, p. 11-12.

Examination of cycle of cold bonderizing using Societa Montecatini's F3A/F3B equipment. (F26r; NM-h)

85-F. Analysis of Die Profiles in Wire Drawing. L. W. Hu. *Franklin Institute Journal,* v. 263, Apr. 1957, p. 317-329.

Method for the stress analysis of wiredrawing using dies of any given profile. Examples of straight, concave, convex and bell-shape dies investigated. 10 ref. (F28, Q25, W23)

86-F. Effect of Critical Cold Reductions on the Structure and Magnetic Properties of Hot Rolled Transformer Sheet. B. Trakhtenberg. *Henry Brutcher Translation* no. 3838, 5 p. (From *Stal',* v. 16, no. 4, 1956, p. 343-347.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 133-F, 1956. (F23, P15, P16, AY)

87-F. Effect of Surface-Active Lubricants Upon the Drawing of Metal Wire. V. D. Chistota, S. Ya. Veiler, V. I. Likhtman and P. A. Rebinder. *Henry Brutcher Translation* no. 3872, 4 p. (From *Doklady Akademii Nauk SSSR,* v. 110, no. 4, p. 562-565.) Henry Brutcher, Altadena, Calif.

Study of action of various lubricants on the cold drawing of steel wire. Correlation between number of carbon atoms in chain of lubricant and die pull. Effect of temperature (68 and 140° F.); soap solution (0.4%) as lubricant for prestrained wire. (F28, 2-11; NM-h)

88-F. (English.) **Steels for Large Forgings.** *Aciers Fins & Speciaux,* no. 25, Mar. 1957, p. 73-79.

Various operations and factors involved in the large forging technique, including details on the choice of steel and its manufacture. (F22; ST)

89-F. (Italian.) **Analysis of Deformation of Material During Wire Drawing.** Mario Lanfranco. *Ingegneria Meccanica,* v. 5, Dec. 1956, p. 33-42.

Deformation and stresses in cold plastic working in light of theories of elasticity and plasticity; applications to wiredrawing. Characteristic parameters in wiredrawing: coefficient of deformation and reduction of section. Forces and tensions present during stretching and deformation of fibers; diagram of tensions inside die; friction. 14 ref. (F28, Q24m)

90-F. (Portuguese.) **Problem of Rolling Steel in Latin America.** Edmundo de Macedo Soares e Silva. *Engenharia, Mineracao e Metalurgia,* v. 24, Dec. 1956, p. 353-355.

Geographical factors, raw material supply problems, personnel problems; existing equipment in mills in Brazil; flexibility and versatility requirements of equipment as conditioned by Latin American market; problem of labor force still in stage of acquiring experience. (F23, 1-2, A4; ST)

91-F. (Russian.) **Rolling and Heat Treatment of Titanium.** N. P. Zhetvin and V. K. Belosevich. *Tsvetnyye Metally,* Jan. 1957, p. 72-81.

Profiles may be rolled from a titanium-aluminum alloy without any

particular difficulty. It is best to conduct finishing operations at 200-300° C. The hot rolling of sheets from commercial titanium and from a titanium-aluminum alloy is feasible up to a thickness of 2.0-2.4-mm. A forged sheet bar is used for the hot rolling of sheet and a forged bar for the rolling of sections. The rolling of sheets in piles is possible up to a thickness of 0.8-1.0 mm. but is not practical because of the considerable oxygenation and hydrogenation of the metal. The cold rolling of commercial titanium into sheets up to 0.8 mm. thick and strip up to 0.3 mm. thick is feasible. Commercial titanium should be annealed at 680-700°, while titanium-aluminum alloys should be annealed at 750-800°. Soaking time should be 4-5 min. per mm. thickness of the sheet or strip. (F23, J23; Ti)

92-F. (Swedish.) **Influence of Rolling Mill Spring on the Dimensions of the Rolled Product.** Hans Warrol. *Jernkontorets Annaler*, v. 141, no. 1, 1957, p. 28-36.

Theoretical investigation of the elastic deformation of the rolled material. Application in the design of roll stands. (F23, Q21, 1-2, 17-1)

Secondary Mechanical Working

Forming and Machining

150-G. Industrial Application of Cold-Flow Extruded Steel Parts. H. D. Feldmann. *Draht* (English Edition), no. 27, Feb. 1957, p. 18-29.

Development of cold-flow extrusion process; examples of suitable steels and shapes; among the advantages listed are superior mechanical properties, surface finish, fiber structure and accuracy; numerous applications include motor car electrical and fire fighting equipment components. (G5; ST)

151-G. A New Straightening Process. Manfred Müller. *Draht* (English Edition), no. 27, Feb. 1957, p. 42-46.

Machine equipped with rollers with trapezoidal thread used for straightening valves, push-rods and case-hardened shafts. (G23p, 1-2)

152-G. Research on the Cutting Performance of Fine Grain Abrasive Stone. Tokio Sasalii and Kenjiro Okamura. *Kyoto University, Memoirs of the Faculty of Engineering*, v. 18, Oct. 1956, p. 354-366.

Numerous fine-grain abrasive stones of various bond hardness, bond combining ratio, porosity and grain combining ratio, were measured for the purpose of improving cutting performance. Special testing apparatus with which stone wear, stock removal and cutting resistance could be measured was employed. (G17; NM-j)

153-G. Hot Forming, Assembly and Service Applications of Magnesium Alloys. *Machinery*, v. 90, Feb. 15, 1957, p. 376-381.

Requirements for press forming, stretch forming, deep drawing and pressing; surface protection, joining methods, including welding and adhesive bonding; current applications of wrought magnesium; recent developments in magnesium alloys. (G general, K general, T general; Mg)

154-G. Spark Machining: Equipment and Applications. D. W. Rudorff. *Machinery Market*, no. 2938, Mar. 8, 1957, p. 23-26.

Various factors bearing upon the efficiency of spark-erosion operations. Mechanical features of a typical spark-erosion machine and the range of machining operations for which spark cutting machines can be designed. (G24a, 1-2)

155-G. Ceramics and Carbides Compared. L. B. Monosmith and W. G. Fisher. *Metalworking Production*, v. 101, Feb. 22, 1957, p. 325-328.

Progress report gives data from tests with SAE 4140 and 8620 machined with two makes of ceramic tool bits, conventional cemented carbides and high-titanium tungsten carbides. (G17; SGA-j, 6-19, 6-20)

156-G. Extensive Test Runs Reported on Ceramics. George H. De Groat. *Metalworking Production*, v. 101, Feb. 22, 1957, p. 329-332.

Ceramic cutting tools tested with variety of materials including AISI 8617, 4145, toolsteel and naval brass. Data on speeds, feeds, tool geometry and finishes obtained. (G17; AY, TS, Cu-n, SGA-j, 6-20)

157-G. Molybdenum Disulphide Cuts Machining Costs. *Metalworking Production*, v. 101, Mar. 1, 1957, p. 366.

Colloidal molybdenum disulphide used as additive for cutting lubricants and coolants increased tool life in milling and turning operations. (G17; NM-h)

158-G. More Tests With Ceramics Versus Carbides. B. D. Smith and F. L. Helmel. *Metalworking Production*, v. 101, Mar. 1, 1957, p. 369-371.

Progress report on ceramics gives data from tests made in cutting AISI C1051 steel comparing six ceramics with standard carbide and titanium carbide. (G17; CN, SGA-j, 6-19, 6-20)

159-G. Ford Speeds Gear Turning With Ceramics. George H. De Groat. *Metalworking Production*, v. 101, Mar. 1, 1957, p. 371-373.

Progress report describes finish machining of standard transmission slide and gear with ceramic tools at Ford Motor Co. (G17g; ST, SGA-j, 6-20)

160-G. More Light on Electric-Erosion. *Metalworking Production*, v. 101, Mar. 1, 1957, p. 382-387.

Machining by spark discharge giving basic principles, requirements for dielectric, electrode feed control, rate of erosion, electrode material and spark-produced surface. (G24a)

161-G. Cost Cutting With Grinding Wheels—Pt. 2. Work Pressure and Wheel Selection. John A. Mueller. *Modern Castings*, v. 31, Mar. 1957, p. 34-35.

Work pressure is extremely critical in its effect on wheel life and cutting rates, particularly with softer wheels. (G18)

162-G. An Analytical Study on Grinding Resistance. Kenji Sato. *Tohoku University, Technology Reports*, v. 21, no. 1, 1956, p. 147-177.

Theoretical calculation and description of experiments on grinding resistance. (G18)

163-G. (French.) **Machining of Copper and Copper Alloys. Pt. 2. General Machining.** *Cuivre Laitons Alliages*, no. 35, Jan-Feb. 1957, p. 7-10.

Enumeration of tool nomenclature; description of tool operations; effect of shear angle; angle of clearance; cutting angles; special reference to copper, lead, bronze and brass. (To be continued.) (G17; Cu, Pb)

164-G. (French.) **Conical Deep Drawing and Impact Extrusion of Metals and Light Alloys. Pt. II.** Robert Chopin. *Revue de l'Aluminium*, no. 238, Dec. 1956, p. 1147-1154.

Procedures of inverted pressing, flow-turning and spinning of large parts; possibilities of impact extrusion processes are evaluated and an empirical method for calculating the force of the extrusion is outlined. (G4b, G13, G5)

165-G. (German.) **Cutting of Metal With Fiber Reinforced Grinding Wheels—a Highly Economical Procedure.** B. Kleinschmidt. *Metall*, v. 11, Feb. 1957, p. 116-119.

In general, cutting times are 12 to 50 times shorter when grinding wheels instead of circular saws are used. Advantages are fast amortization of cutting machine, smooth cutting plane, and no structural change of material by heating effects. (G18m, 1-2)

166-G. (German.) **Profile Milling of Heavy Workpieces.** K. Häuser. *Werkstatt und Betrieb*, v. 90, Mar. 1957, p. 191-196.

Profiling machines for the handling of large and awkwardly shaped work, particularly for the production of dies and casting molds. Large types have been developed from standard horizontal boring and milling machines. (G17b, G17d, 1-2)

167-G. (German.) **Cutting Forces During Grinding. Pt. I. Influence of Working Conditions.** H. Krug. *Werkstattstechnik und Maschinenbau*, v. 47, Jan. 1957, p. 26-35.

Structural parts of the grinding machine and their dimensions. Selection of motor horsepower and size of grinding shaft. Forces to machine material are dependent upon two groups of variables: (1) working conditions such as feed speed and depth of cut, (2) condition of grinding wheel, type of grain, binder and coolant. Second group not as well controlled as first one. 12 ref. (G18)

168-G. (German.) **Unbalance and Centrifugal Force of Grinding Wheels.** O. Kienzle and H. Münnich. *Werkstattstechnik und Maschinenbau*, v. 47, Feb. 1957, p. 69-73.

Vibrations caused by free centrifugal forces in unbalanced grinding wheels. Increasing demands for high-quality surface finishes require elimination of unbalance. Tolerances and standards. 7 ref. (G18)

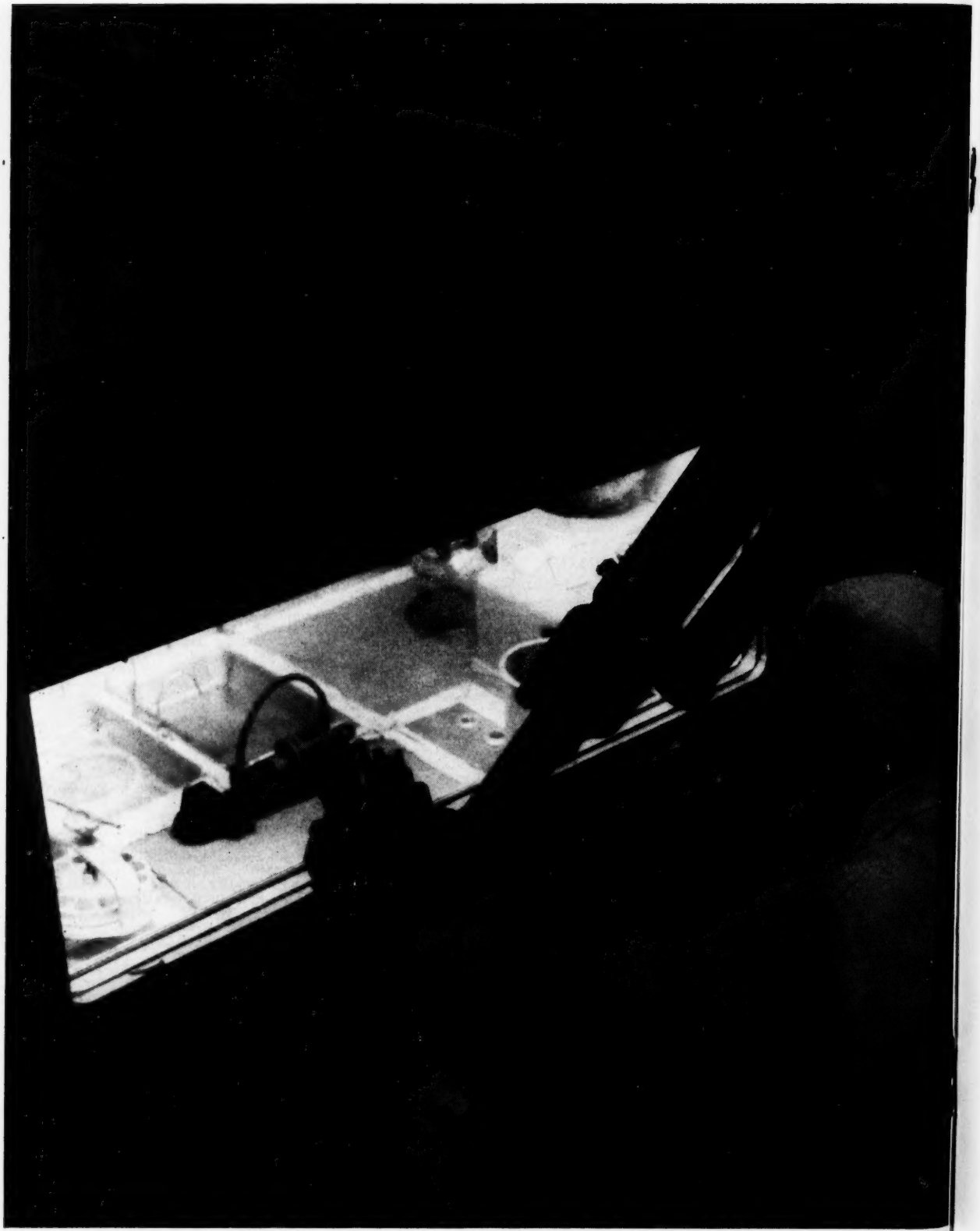
169-G. (German.) **Cutting Forces During Surface Grinding. Pt. 2. Influence of Grain Size, Binder and Coolant.** H. Krug. *Werkstattstechnik und Maschinenbau*, v. 47, Feb. 1957, p. 73-78.

Influence of brittleness and toughness of abrasive and binder on cutting forces. Different abrasives, ceramic and plastic binders, dry and wet surface grinding. 2 ref. (G18k; NM-j)

170-G. (Italian.) **Contribution to the Study of the Cutting of Metals on Lathes.** Pietro Chiesorin. *Ingegneria Meccanica*, v. 5, Apr. 1956, p. 55-64.

New device designed by author for determining from three component stresses (principal, axial and normal) the cutting stress in turning operations; some experimental results obtained with the use of this instrument. Device permits direct reading. (G17k, 1-2)

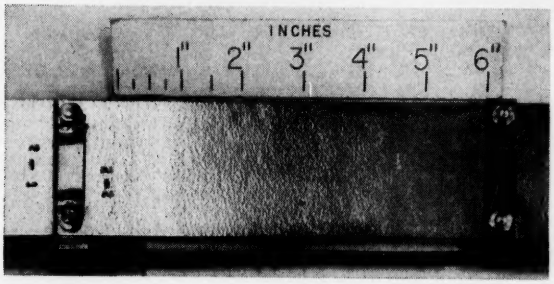
171-G. Ceramic Tools for Single-Point Turning. A. B. Albrecht. *Machinery*, v. 63, Apr. 1957, p. 149-155.



Fred Bingman, Metallographer, prepares metallographic specimens of irradiated materials by remote operation inside a shielded metallographic facility in the Bettis Atomic Power Division hot lab.

An Experimental Fuel Study of Uranium Alloys

A typical test array of instrumented uranium alloy fuel plates.



At Bettis Atomic Power Division laboratories, engineers and scientists are conducting basic research in the field of solid state physics and metallurgy to determine the behavior of nuclear materials under actual reactor conditions.

The experimental fuel plates shown on this page represent the initial step in a study of the temperature dependence of fuel materials to fission gas induced volume changes. These plates on an uranium-niobium alloy have been fabricated with thermocouples in the interior of the plates for constant temperature monitoring. The fuel enrichment is varied to provide the range of fuel temperature and fissioning rates of interest. The samples are being irradiated in a high temperature-high pressure recirculating water system at the NRX reactor site of Atomic Energy of Canada, Ltd., at Chalk River, Canada. The experiment will provide, in addition to data on fuel volume changes, information on neutron induced phase transformation kinetics and crystallographic changes.

This experimental fuel study is part of a joint program between the United States Atomic Energy Commission and Atomic Energy of Canada, Ltd. Bettis Plant conducts similar tests on nuclear fuel, control rod, and structural materials at other sites throughout the United States.

One of the foremost problems that face Bettis metallurgists is the dimensional stability of fuel materials under conditions of high temperature and high fuel burnup. Some of the experiments in connection with this problem include in-pile studies of phase transformation kinetics and fission gas diffusion rates. They also employ remotely operable X-ray and metallographic techniques in the post-irradiation analysis of samples of this type.

This is only one example of the challenging work conducted at Bettis Atomic Power Division. To investigate the excellent opportunities offered by the leader of the nuclear power industry, address your résumé to: Mr. M. J. Downey, Bettis Atomic Power Division, Westinghouse Electric Corporation, Dept. A-166, P.O. Box 1468, Pittsburgh 30, Pa.

Also, outstanding young metallurgists should write today for a descriptive brochure on our unique doctoral fellowship program in cooperation with Carnegie Institute of Technology.

BETTIS ATOMIC POWER DIVISION

Westinghouse

Next month—The Research and Development of Nuclear Fuels—A Study of Property Changes Under Radiation at Low Temperatures.

Consideration of fundamental advantages of ceramic tools, tooling requirements and application to production machining.
(G17, T6n; SGA-j, 6-20)

172-G. What the Designer Should Know About Cold-Heading. Theodore B. Smith. *Machinery,* v. 63, Apr. 1957, p. 194-201.

Part designer should keep in mind cold heading, which is a high-speed process producing parts with excellent grain structure, good tolerance and little scrap. Examples of parts made by cold heading. (G10, 1-17)

173-G. Titanium Alloy Suited for Stretch Formed Parts. E. J. Carr. *Materials and Methods,* v. 45, no. 4, Apr. 1957, p. 140-141. (CMA)

Ti-6Al-4V may be stretch-formed at 70° F. using conventional tools and methods, but control of jaw grip and the heat treated condition are important. High forming pressures are required. Forming tests at Boeing showed that titanium shims or clean steel jaws give the best grip, that the aging cycle used on the parts produced little distortion if they are unrestrained, that springback is not easy to remove in full hard parts, and that graphite cup grease is a suitable lubricant. (G9; Ti)

174-G. Cost Cutting With Grinding Wheels: Pt. 3. Increasing Cut-Off Wheel Efficiency. John A. Mueller. *Modern Castings,* v. 31, Apr. 1957, p. 58-59.

Stresses control of speed, cut-off rate and selection of proper wheel. (G18, 1-2)

175-G. Ingenious Tooling Simplifies a Tough Job. Henry Kowalski. *Modern Industrial Press,* v. 19, Mar. 1957, p. 25-27.

Stamping, forming and welding operations in the production of clothes dryer drums. (G general)

176-G. 950,000 Small Stampings a Day. Howard E. Jackson. *Modern Industrial Press,* v. 19, Mar. 1957, p. 30-32.

Production from coil steel strip of 400 tons of saw chains per day. (G3; ST)

177-G. Forming Titanium and Titanium Alloy Sheet by Stretching and Other Methods—Pt. 2. R. A. Kiehl. *Sheet Metal Industries,* v. 34, Apr. 1957, p. 273-285. (CMA)

Die materials used for aluminum and stainless may be used for rubber forming titanium. Steel blocks should be used for hot forming titanium. Brake forming methods used with stainless are also applicable. The same is true for stretch-wrap forming except that more operative skill is required. A planning sequence of 32 steps is presented. Skin stretching is confined to commercial titanium. Drawn parts may be formed hot or cold depending on severity; results of hot drawing tests are described. Drop or power-hammer parts can be formed on conventional tools if local heating and good technique are used. Data presented for dimpling, joggling and spinning. (G9, G general; Ti)

178-G. Titanium Fabrication From A to Z. *Steel,* v. 140, Apr. 22, 1957, p. 94-95, 98, 100. (CMA)

Three prototype assemblies of Rem-Cru A-110AT were made by the Jet Division of Thompson Products after using at least 15 precision processes, including hot coining, piercing, drilling and tapping, hot brake forming, hot draw forming, hot sizing and radial draw forming. Plastic enclosures were used for manual welding. (G general; Ti)

179-G. Metal-Cutting Evaluation. Current Status of Various Techniques Used. F. J. Daasch. *Steel Processing and Conversion,* Mar. 1957, p. 136-141.

Review of present methods, study of tool life, tool forces, power consumption and surface quality and variables to be considered in their evaluation. 20 ref. (G17, 1-4)

180-G. Tests Compare Finishes From Cermaic and Carbide Tools. M. C. Shaw and P. A. Smith. *Tool Engineer,* v. 38, Apr. 1957, p. 97-102.

Data on microfinish, cutting force components obtained in machining AISI 1020 and 4340 steels at different speeds with ceramic and carbide cutting tools. (G17, SGA-j, 6-19, 6-20)

181-G. Safe Operation of Abrasive Wheels. *Tool Engineer,* v. 38, Apr. 1957, p. 119-122.

Precautions to be observed in selecting and operating abrasive wheels. (G18, A7p)

182-G. Machining and Welding of Titanium at Orenda Engines Ltd. L. E. Gray. *Welding and Metal Fabrication,* v. 25, Apr. 1957, p. 118-124. (CMA)

Recent years have seen much improvement in the titanium received from foundries and mills. The prime requirement in welding titanium is the exclusion of embrittling atmospheric gases from the weld. The color of the weld indicates the degree of contamination and a light straw color is tolerable. Several photographs and diagrams are shown for the welding fixtures and chambers used by Orenda. Other operations discussed are the forming of titanium sheet, roughing forged compressors of titanium and broaching. (G17, K general; Ti)

183-G. Report on Dynatomics—Phase II. A. McBride. *Western Machinery and Steel World,* v. 48, Mar. 1957, p. 91-93.

Report of application of recommended coolants in cutting and turning processes on production scale; improved tool life and higher surface finish. (G17, NM-h)

184-G. (English.) **Study on Wear Process of Carbide Tools.** Hidehiko Takeyama, Terumi Murai and Eiji Usui. *Mechanical Laboratory of Japan, Journal,* v. 2, no. 2, 1956, p. 14-24.

Tool life when machining high-grade cast iron and nickel-chromium-molybdenum steel.
(G17, Q9n; SGA-j)

185-G. (German.) **Machining of Titanium.** H. Westphal. *Werkstatstechnik und Maschinenbau,* v. 47, Mar. 1957, p. 123-127. (CMA)

Using published American data, the following processes of machining titanium and its alloys are briefly reviewed: turning, boring, tapping, planing, broaching, milling and grinding, and information on sawing. 19 ref. (G17; Ti)

186-G. (Spanish.) **Quantity Production With Oxygen Cutting.** E. Seymour-Semper. *Ciencia y Técnica de la Soldadura,* v. 7, Jan-Feb. 1957, 10 p.

Comparison with mechanical methods of edge preparation; figures on productivity and precision attained by oxygen cutting. Performance of oxygen cutting can be improved notably by continuous feeding of stock and systematic mechanical handling of cut pieces. Description of multiple blowpipe machines; use of jigs and electronic tracers. (G22g, 1-2)

187-G. Metallurgy of Steels for Deep-Drawing. A. J. K. Honeyman. *Birmingham Metallurgical Society Journal,* v. 37, Mar. 1957, p. 265-496.

Review of metallurgy of deep drawing with definition and information on relationship of mechanical properties of mild openhearth steel sheet and strip to chemical composition, grain size and structure and prior cold work. Theories of yielding and aging, assessment of deep drawing properties, origin and effect of ingot surface defects.
(G4b, Q23; ST, 4-3, 9-21)

188-G. Choosing Disk-Type Wheels for Weld Grinding and Finishing. *Industry and Welding,* v. 30, Apr. 1957, p. 54-60.

Five groups of depressed center reinforced flexible type disk wheels and selection of proper group for weld metal being ground.
(G18k; 7-1)

189-G. Tooling for Short-Run Production. John Waller. *Sheet Metal Industries,* v. 34, Apr. 1957, p. 257-262.

Equipment and set-up for piercing and cutting metal sheets using Unipierce and Unicrop units. (To be continued.) (G2; 4-3)

190-G. High Production Machining and Testing of Hydraulic Valves. C. E. Schultheis. *Tooling and Production,* v. 23, Apr. 1957, p. 101-104.

Equipment and procedures used in machining, grinding and testing cast iron hydraulic valves at International Harvester Co.
(G17, T7b; CI)

191-G. Strain Hardening and Residual Stresses in the Boring of Structural Steels. P. E. D'yachenko and N. A. Podosenova. *Henry Brutcher Translation* no. 3753, 3 p. (From *Vestnik Mashinostroeniaa,* v. 34, no. 7, p. 45-47.) Henry Brutcher, Altadena, Calif.

Investigation of possibility of selecting such conditions of machining as will insure an optimum distribution of the residual stresses to reduce the machining stresses and improve the fatigue strength of the part being machined.
(G17, Q25h, Q7a; ST)

192-G. Gas Cutting of Steel in Continuous Casting Machines. O. Sh. Spektor. *Henry Brutcher Translation* no. 3888, 7 p. (From *Stal',* v. 16, no. 11, 1956, p. 1042-48.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 9-G, 1957.
(G22, D9q; CN)

193-G. (English.) **A New Method of Electro-Machining of Hard Metals.** Tasaburo Yamaguti. *Physical Society of Japan, Journal,* v. 12, Feb. 1957, p. 204-208.

An ordinary alternating current is used, superposed with some adequate high-frequency electric oscillations. The metal and the tool are dipped in water and are adjusted to keep a certain small separation. Thus, we can initiate favorable quenched discharges in every half cycle in which the metal is in positive potential. A merit of the present method is that the developments of any cracks in the machine surface are entirely prevented, even for hard metals, such as tungsten.
(G24a; W, EG-d)

194-G. (French.) **Impact Extrusion of Aluminum Disks and Meter Gears.** *Machine Moderne et Revue Mecanique,* no. 577, Apr. 1957, p. 21-24.

Details of the conception and con-

struction of dies used for the impact extrusion of high-precision aluminum pieces sufficiently light to cause minimal friction in the mechanism of electric meters. Equipment employed. (G5, T7; Al)

195-G. (French.) **Bumper Manufacture at the Chevrolet Plants.** Herbert Chase. *Machine Moderne et Revue Mecanique,* no. 577, Apr. 1957, p. 78-80.

Thin sheets of high-strength steel alloys, with thicknesses varying from 2.5 to 3.5 mm., are flame cleaned and polished. To protect the surface against scratches and to facilitate stamping operations, the sheets are coated first with phosphate and then with a lubricant.
(G3, L10g, L12; AY, 4-3)

196-G. (German.) **Machining Titanium With Carbide Tools.** *Technica,* v. 6, Feb. 1, 1957, p. 112-113. (CMA)

The inconsistency of the favorable chip length ratio and poor machinability of titanium is discussed; greater friction and poor heat conductivity are the explanation. Galling of the chip on the tool rapidly promotes tool failure. Heat generation is decreased by slow speeds or by altering the tool geometry. Speeds and tool geometries for carbide tools are reviewed. Rigid tool setups are required.
(G17, Ti, SGA-j, 6-19)

197-G. (Italian.) **Notes on the Machining of Stainless Steel.** Ambrogio Galbiati. *Macchine,* v. 12, Feb. 1957, p. 139-159.

Turning operations with templates; bending of sheet. (Third article in a series.) (G17, G6; SS)

198-G. (Book—Russian.) **Investigations on the Deep Drawing of Metals, No. 29.** 143 p. 1956. Moscow Aviation Technological Institute, Oborongiz, Moscow.

Results of a series of theoretical and experimental tests conducted at the stamping laboratory of the Moscow Aviation Technological Institute and dealing with the stamping of parts from sheet material. Special attention is given to the deep drawing of parts in which the blanks are preheated. (G4b)

H Powder Metallurgy

31-H. Preliminary Study of Three Cermets Based on Uranium Oxide. L. S. Williams, D. T. Livey, E. Barns and P. Murray. *Journal of Nuclear Energy,* v. 4, Feb. 1957, p. 164-178.

Fabrication and some properties of the three cermets investigated. Fabrication by hot pressing method is feasible, provided an argon atmosphere is used. The use of silicon as the metallic constituent at 20% by volume improves oxidation resistance of uranium oxide in air at temperatures up to 900° C. 10 ref.
(H14h, R1h; U, 6-20)

32-H. Carbides That Are Weldable, Machinable and Heat Treatable. John L. Ellis. *Tool Engineer,* v. 38, Apr. 1957, p. 103-105.

Physical properties and methods of production involving compaction in sintering of titanium carbide followed by infiltration with steel. Cutting tool material can be machined in annealed condition, responds to heat treatment and is weldable and costs less than cemented tungsten carbide. (H15n, H16e; SGA-j, 6-19)

33-H. An Investigation of the Slip-Casting Mechanism as Applied to Stainless Steel Powder. W. G. Lidman and R. V. Rubino. Sylvania Electric Products, Inc. *U.S. Atomic Energy Division,* SEP-208, Feb. 23, 1956, 23 p.

The slip-casting technique, which is successfully employed in the ceramic industry, was utilized to produce sintered stainless steel components experimentally. The procedure used is described, along with an evaluation of the physical and mechanical properties of the samples produced. (H general; SS)

34-H. (Russian.) **Study of the Possibility of Preparing Metal-Ceramic Hard Alloys From Borides of Chromium, Titanium and Tungsten.** I. I. Iskok'dskii and L. P. Bogorodskaya. *Zhurnal Prikladnoi Khimii,* v. 30, Feb. 1957, p. 177-185. (CMA)

It is shown that it is impossible to prepare metal-ceramic alloys from borides of chromium, titanium and tungsten using iron, nickel or cobalt as binders, since these metals react chemically with the above borides. The interstitial metal interacts with the borides during sintering and disappears. These interactions point to the existence of a new kind of ternary boron-metal system. 11 ref.
(H general; Cr, Ti, W, 6-20)

35-H. (Book—Russian.) **Questions on Powder Metallurgy and the Strength of Materials, No. 111.** 1956. 145 p. Institute of Metalloceramics and Special Alloys, Academy of Sciences Ukrainian SSR, Kiev, U.S.S.R.

Includes the following articles: The Elastic Constants of Metals and Alloys, by I. N. Frantsevich; The Phenomenon of Electromigration in Solid Metallic Solutions, by I. N. Frantsevich and D. F. Kalinovich; The Interaction of Titanium Carbide With Nickel, by V. N. Yeremenko, V. M. Polyakova and Z. P. Golubenko; The Interaction of Titanium Carbide With Cobalt, by V. N. Yeremenko and N. D. Lesnik; The Comparative Investigation of the Properties of Iron Powders, by I. M. Fedorchenko, N. A. Filatova and N. N. Sereda; The Conditions for Production of the Properties of Metalloceramic Aluminum, by G. K. L'vov; Geometric Parameters of the Hysteresis Loop as Characteristics of the Damping Properties of Material, by G. S. Pisarenko and V. V. Khil'chevskiy; Heat Resistant Alloys Based on Titanium Carbide, by V. V. Grigor'yeva.
(H general, N general, Q general)

J Heat Treatment

89-J. High-Vacuum Annealing. Werner Herdieckerhoff. *Draht* (English Edition), no. 27, Feb. 1957, p. 38-40.

Conventional equipment and principles of operation; description and advantages of high-vacuum annealing unit; applications include copper and nickel, wire and strip; high, low or special alloy steel strips.
(J23, 1-23, 1-2, Cu, Ni, AY)

90-J. Low-Temperature Annealing of Drawn Wire. Kenichi Nakamura and Yoshimune Nakamura. *Mechanical Laboratory of Japan, Journal,* v. 2, no. 2, 1956, p. 25-28.

Investigation of the hardening phenomena that occur when low-temperature annealing is conducted on carbon steel wire that has been drawn through a die, and the determination of appropriate conditions for improving the mechanical properties of drawn wires under such annealing procedures. 7 ref.
(J23; CN, 4-11)

91-J. Steel Heat Treatment and Furnace Atmosphere. *Mechanical World and Engineering Record,* Mar. 1957, p. 127-129.

Recent developments avoid scaling or decarburization and enable bright finishes to be maintained. (J2k; ST)

92-J. (French.) **Cementation.** G. de Smet. *Pratique des Industries Mécaniques,* v. 40, Jan. 1957, p. 1-10.

Case hardening; description of the process of carbonitriding and gas carburizing; various methods and equipment described. (To be continued.) (J28, 1-2)

93-J. (German.) **Design, Mode of Operation and Operational Results of a Modern Wide Strip Annealing Plant.** Vincenz Seul and Joseph Billigmann. *Stahl und Eisen,* v. 77, Mar. 21, 1957, p. 309-323.

Features of development of the continuous strip annealing furnaces; advantages of continuous annealing; application of continuous annealing furnaces in America and Europe. Annealing furnaces with vertical and horizontal flow of the strip.
(J23, W27, 1-11; ST, 4-3)

94-J Selection and Heat Treatment of Materials for Traction Gears. Heinrich Staudinger. *AEG Progress,* no. 3, 1956, p. 216-223.

Discussed with particular reference to the residual stresses which arise during the various processes employed for the surface hardening of steels. For a highly stressed spur gear, heat treatable steels with surface hardened teeth may often be used instead of the case hardening steels which were commonly used in the past. Surface hardening is then carried out by the induction or flame hardening method or even by dip hardening and nitriding of steels with a carbon content of about 0.35 to 0.45%. (J28, T7a; ST)

95-J. Heat Treatment of Titanium. P. D. Frost. *Metal Treating,* v. 8, Mar-Apr. 1957, p. 6-8, 31, 36, 50, 54. (CMA)

Four motives for heat treating titanium alloys. Improved strength results from solution treating to transform alpha to beta and dissolve manganese, iron and other additions, then air or water quenching to retain beta, and finally aging to control beta transformation to fine, dispersed alpha. Omega-phase embrittlement is avoided by aging sufficiently to permit the beta→alpha transformation mechanism in beta alloys to complete. The loss of ductility from working above the beta transus may be minimized by keeping the working range in the alpha-beta temperatures as much as possible. Contamination and distortion during heat treatment may be prevented by various means. (e.g., slat-quench and Mollerizing.)
(J general; Ti)

96-J. Case-Hardening of Carbon and Alloy Steels. J. E. Jubb. *Metal*

Treatment and Drop Forging, v. 24, Mar. 1957, p. 99-104, 106.

Metallurgical principles and practical aspects of box-carburizing with solid compounds and cyaniding in salt bath including packing, temperature and case depth control, methods of refining grain in core and selective hardening; types of faults developed. (J28; CN, AY)

97-J. The Metallographic View—32. Metallographic Characteristics of Cyanided and Carbonitrided Cases. Howard E. Boyer. *Steel Processing and Conversion,* v. 43, Mar. 1957, p. 142-143, 170.

Hardness and microstructure study of case on SAE 1020 carbon steel formed by cyaniding in molten bath or by carbonitriding in gaseous atmosphere.
(J28j, J28m, M27, Q28n; CN)

98-J. Air Injection. A New Carburizing Control Technique in Zoned Atmosphere Furnace Operation. H. C. Harris. *Steel Processing and Conversion,* v. 43, Mar. 1957, p. 158-162.

Details of process and furnace for continuous gas carburizing of gears from variety of alloy steels including SAE 8620H and AISI 4023. Problem of maintaining surface carbon content of not more than 0.80% and still providing sufficient case depth met by close control of atmosphere consisting of propane and endothermic generator gas in the second and third zones of furnace, straight generator gas in the fourth and fifth zones with air introduced near discharge end of fifth and final zone. (J2k, J28g, 1-11; AY)

99-J. Nitriding and Carbonitriding of Titanium Metal and Its Alloys. Final Technical Report. A. Styka. Watertown Arsenal Laboratory. Report 401/49/23. *U.S. Office of Technical Services,* PB 123974, Aug. 1953, 55 p. (CMA)

Hard adherent surfaces are produced on titanium and its alloys by nitriding in nitrogen and dissociated ammonia; the procedure is described. Impact and tensile strengths and structure were evaluated. Carbonitriding in propane, air and ammonia mixtures was studied for the effect of temperature, time and gas mixture. (J28k, J28m; Ti)

100-J. Direct Flame Hardening With Natural Gas. Arthur Q. Smith. *Industrial Gas,* Apr. 1957, p. 10-12.

Direct flame hardening allows use of lower cost steels and reduces subsequent machining costs. Single operation also saves valuable time. New equipment described.
(J2h, 1-2; RM-m35)

101-J. How Long, How Fast to Heat Tool Steel. Pt. 1. *Iron Age,* v. 179, Apr. 4, 1957, p. 79-99.

Effect of metal surface and furnace temperature on heating rate, difference between center and surface temperatures. (J2, 3-17; TS)

102-J. Hot Oil Quenching. L. W. Kalinowski. *Metal Treating,* v. 8, Mar-Apr. 1957, p. 10-12, 54-56, 59.

Processes for full and modified martempering of steels and advantages derived from use of hot oil compared to salts as quenching medium; benefits from using process on automotive clutch hubs, roller bearings and other steel parts; requirements and tests for quenching oils. (J26; ST, NM-h)

103-J. Principles and Practical Aspects of Titanium Heat Treatment. P. D. Frost. Battelle Memorial Institute. Report 8. *U.S. Office of Technical Services,* PB 124563, June 1955, 24 p. (CMA)

Beta-stabilizing additions make titanium heat treatable while aluminum increases high-temperature strength and improves hot working. All alpha-beta alloys respond to some degree of solution and aging heat treatments; the latter should exceed 800° F. to avoid embrittlement. Stress-relief temperatures should not be high enough to cause much transformation to beta, nor should alloys be hot worked above the beta transus.
(J27a, J1a, 1-10; Ti)

104-J. (French.) **Observations on the Heat Treatment of Aluminum-Zinc-Manganese-Copper Alloys.** M. Tournaire and G. M. Renouard. *Metaux-Corrosion-Industries,* no. 379, Mar. 1957, p. 95-101.

Study of the relationship between heat treatments and mechanical characteristics (elastic limit and breaking load) of these alloys.
(J general, Q21b, Q23; Al, *Zn, Mn, Cu*)

105-J. (German.) **Flame Hardening of Cast Iron.** E. A. Hohmann. *Giesserei-Praxis,* v. 75, Jan. 25, 1957, p. 47-49.

Flame hardened cast iron component surfaces show increased fatigue limits and a treble to quadruple work life. (J2h, Q7a; CI)

106-J. (Japanese.) **Heat Treatment of Copper Alloys.** Ko Tanaka and Kagno Sonobe. *Metals,* v. 27, Apr. 1957, p. 265-269.

Annealing for softening, segregation and aging; low-temperature annealing. (J23, J27d; Cu)

107-J. (Japanese.) **Heat Treatment of Alpha Solid Solutions of Copper Alloys.** Gungi Shinoda and K. Amano. *Metals,* v. 27, Apr. 1957, p. 270-275.

Mechanism of hardening by annealing; relation of annealing temperature and annealing time; aging of alpha solid solutions of copper alloys. 24 ref. (J23, J27d; Cu)

108-J. (Japanese.) **Heat Treatment of Aluminum Alloys.** Tojiro Kobayashi. *Metals,* v. 27, Apr. 1957, p. 278-282.

Characteristics of aluminum alloys with regard to heat treatment.
(J general; Al)

109-J. (Japanese.) **Heat Treatment of Magnesium Alloys.** Michiyuki Tanji. *Metals,* v. 27, Apr. 1957, p. 283-288.

Heat treatment furnaces for use with magnesium alloys; mechanical properties of magnesium alloys.
(J general, Q general, W27; Mg)

110-J. (Japanese.) **Heat Treatment of Zinc and Zinc Alloys.** Usabro Nishioka. *Metals,* v. 27, Apr. 1957, p. 289-294.

Results of heat treatment of zinc, zinc-aluminum alloys, zinc-copper alloys, zinc-magnesium alloys and die-cast zinc alloys are evaluated on the Vicker's hardness scale.
(J general, Q29c; Zn, 5-11)

111-J. (Japanese.) **Heat Treatment of Nickel Alloys.** Shinich Nakata. *Metals,* v. 27, Apr. 1957, p. 295-299.

Bright annealing, soft annealing, temper or semi-annealing, stress-equalizing annealing and age hardening of nickel alloys.
(J23, J27d; Ni)

112-J. (Japanese.) **Heat Treatment of Noble Metals.** Yuzo Yoshikawa. *Metals,* v. 27, Apr. 1957, p. 301-303.

Palladium, platinum, platinum alloy, gold-silver-copper alloys, gold-platinum alloys, gold-platinum, palladium-silver-copper alloys are discussed. (J general; EG-c)

K Assembling and Joining

168-K. Welding Techniques in Atomic Energy Plants. I. H. Hogg. *Atomics and Nuclear Energy,* v. 8, Mar. 1957, p. 77-99.

Details of the particular problems confronting the welding engineer in the construction of atomic energy plants and the methods by which these were overcome. 29 ref.
(K general, W11)

169-K. Welding Steel Castings. *Australasian Manufacturer,* v. 41, Feb. 16, 1957, p. 88-95, 106-107.

Establishing welding procedures; advantages of tungsten inert-gas arc welding, metallic inert-gas arc welding and submerged arc welding.
(K1d, K1e; ST, 5)

170-K. New Unionarc System Features Magnetic Flux. *Canadian Machinery,* v. 68, Mar. 1957, p. 169-172.

Unionarc system ensures good visibility and a high rate of deposit. Materials need not be clean and are easily and neatly bridged. (K1e)

171-K. Induction Brazing. A. T. Templin and H. S. Peterson. *Machine Design,* Mar. 21, 1957, p. 150-153.

Induction brazing is widely used for joining parts in high production. High-volume parts produced as one-piece units may show savings by conversion to two-piece brazed assemblies. When volume is high enough to justify the equipment involved, parts originally joined by hand brazing, furnace brazing or arc welding may be readily redesigned for induction brazing. (K8k)

172-K. Resistance Welding: Some Developments. N. K. Gadner. *Mass Production,* v. 33, Mar. 1957, p. 86-90, 97.

Reasons for adoption of resistance welding by the aircraft industry for many new applications. Design, quality control and productivity discussed. (K3, T24, 17-1)

173-K. Zirconium Welded in Dry Box. *Metalworking,* v. 13, Apr. 1957, p. 4-6. (CMA)

In welding atomic reactor channels the entire zirconium assembly is placed inside a dry box filled with inert gas. The fixture moves horizontally in the chamber on its wheels. Tungsten electrode and other equipment used by the Nuclear Products Division, Superior Tube Co. (K1d, 1-2; Zr)

174-K. Welding Alloy Zirconium Requires Special Techniques. W. R. Gall. *Metalworking Production,* v. 101, Feb. 22, 1957, p. 333-335.

Fabrication of zirconium vessel for core of nuclear reactor by use of zirconium wire with arc completely shielded by helium; cleaning, welding and testing procedure.
(K1d, T11; Zr)

175-K. Boom in Welding. *Scope,* Mar. 1957, p. 30-60.

Progress in the welding industry, especially in gas welding repair; electric arc welding—manual, semi-automatic and automatic; resistance welding for many manufacturing operations. (K general)

176-K. Background for Evaluation of Acetylene and Propane. J. Okladek. *Welding Engineer,* v. 42, Mar. 1957, p. 31-34.

Physical and chemical properties of acetylene and propane procedure for comparing value in metal cutting and welding operations. (K2, G22g)

177-K. Welded "Blankets" of Ultra-Thin Stainless. Byron R. Russell. *Welding Engineer,* v. 42, Mar. 1957, p. 38-39.

Stainless steel sheets 0.0005 in. thick are joined using automatic tungsten argon welding fixture. (K1d; SS, 4-3)

178-K. Resistance Uses Are Limited Only by Imagination. Jack Fairlie. *Welding Engineer,* v. 42, Mar. 1957, p 44-48.

Spot and projection welding; their development, principles, uses and definitions. (K3n, K3q)

179-K. (French.) **The Use of Electric Arc Welding Processes for Mild Steels, With High Current Density, Under a Gas Shield.** A. Moreau. *Revue de la Soudure,* v. 13, no. 1, 1957, p. 1-11.

Possibilities and limitations of carbon dioxide shielded welding compared with the more expensive argon shielded process. New technique using eight to ten times the usual current density has been applied to the welding of aluminum, light alloys, stainless steels. Advantages include absence of solid flux, high speed of deposit, visibility of the arc and high quality of the joints. (K1d)

180-K. (French.) **New Process of Automatic Welding in a Carbon Dioxide Protective Atmosphere.** F. Danhier. *Revue de la Soudure* v. 13, no. 1, 1957, p. 12-22.

New process of automatic welding combining the high operating speed of a submerged arc with the ease in use and excellent mechanical properties of a continuous electrode wrapped with basic coating; composition of electrode coatings; tests made with various types of slag; description of welding process and outline of its possibilities. 6 ref. (K1d)

181-K. (French.) **Results of Brittle Fracture Tests Considered From the Fabricator's Point of View.** F. Hebrant, H. Louis, W. Soete and A. Vinckier. *Revue de la Soudure,* v. 13, no. 1, 1957, p. 31-48.

Steel disks into which were introduced artificial defects were used in these tests. Examines influence of various factors, such as residual stress due to welding, location and nature of the defect, quality of the steel, type of joint welded; some tests were also made on sheets. (K9r; ST)

182-K. (French and German.) **International Specifications for Filler Materials in Braze Welding.** G. M. Blanc. *Journal de la Soudure,* v. 47, Mar. 1957, p. 61-66.

Specifications were commissioned by the International Institute of Welding in December 1955. Two documents have been produced, one containing specifications covering the determination of the characteristics of the metal deposited (melting temperature, operating conditions, mechanical tests) and the other producing specifications concerning the strength of the bond on steel, cast iron and other metals. Explains common German, French and English welding terms. (K5, 15-11; SGA-f)

183-K. (French and German.) **Welding of Silicon-Manganese Bronze.** *Journal de la Soudure,* v. 47, Mar. 1957, p. 58-61.

Bronze containing 1% manganese, 3% silicon and 96% copper is currently employed in the manufacture of pressure vessels and apparatus for the chemical industry; description of the cleaning and preparation of sheets prior to welding; use of flux; method employed for both torch welding and arc welding; note on hard and soft soldering. (K1, K2, K7, L12; Cu-s, *Si, Mn*)

184-K. (German.) **Welding in the Nuclear Industry.** F. W. Davis and E. B. LaVelle. *Schweissen und Schneiden,* v. 9, Jan. 1957, p. 5-12.

Welding in radioactive chemical processing plants; maintenance welding in atomic facilities. Welding processes; testing and inspection. 10 ref. (K general, W11, T29)

185-K. (German.) **Welding of Large and Thick Sections by the Electro-Slag Process.** W. Anders. *Schweissen und Schneiden,* v. 9, Jan. 1957, p. 12-24.

General data on a submerged-melt process: welding conditions; machinery and equipment; filling materials and fluxes; applications. 8 ref. (K1e)

186-K. (German.) **Welding in the Mining Industry.** H. Speich. *Schweissen und Schneiden,* v. 9, Jan. 1957, p. 24-29.

Growth of welding in the mining industry. Application of welding in underground and strip coal mining. Future welding requirements of the mining industry. 5 ref. (K general, W14)

187-K. How to Make Sandwich. E. J. Tangerman. *American Machinist,* v. 101, Mar. 25, 1957, p. 137-161.

Methods used by this country's major fabricators in forming, machining, sawing and grinding of aluminum, stainless steel and titanium honeycomb and in bonding with adhesives or brazing on sandwich assemblies of aircraft components; advantages of honeycomb structure. (K12, K8, G general; Al, SS, Ti, 7-9)

188-K. Pressure Welding in Practice. R. F. Tylecote. *British Welding Journal,* v. 4, Mar. 1957, p. 113-120.

Techniques used in preparation and welding of joints by pressure with and without external heating; examples of application of method in joining overlapping sheet material such as copper and aluminum and butt welding of bars, tubes and sections of steel. 21 ref. (K5, K2)

189-K. Aluminum Dip Brazing. Donald E. Wernz. *Machinery,* v. 90, Mar. 8, 1957, p. 541-544.

Wave guide and other complex fabrications joined by aluminum dip brazing. Details of work preparation, fixtures, work assembly and brazing. (K8n; Al)

190-K. Special Welding Techniques. Final Summary Report for 1954. Glenn L. Martin Co. *U.S. Atomic Energy Commission,* AECU 3174, Jan. 31, 1955, 41 p.

The flange-during-welding method was developed to consistently produce high-quality recrystallization welds. With the recrystallization method it is possible to weld reliable and reproducible joints of high strength which will not leak. A method in which preflanged tubes were welded to drilled headers was also found to give high-strength, leakproof connections. (K3)

191-K. Research and Development on the Welding of Aluminum Alloy Plate. J. J. Chyle and I. Kutuchief. A. O. Smith Corp. (Frankford Arsenal). *U.S. Office of Technical Services,* PB 111850, Jan. 1955, 69 p. $1.75.

Successful welding procedures were developed for restrained "H" test plates of 24S-T4 aluminum alloys. Sound, defect-free joints in the 1½-in. thick alloys were welded by the inert-gas tungsten-arc process and the consumable electrode inert-gas shielded metal-arc technique. (K1d; Al, 4-3)

192-K. Ultrasonic Soldering of Aluminum. J. B. Jones and J. G. Thomas. Aeroprojects Inc. (Frankford Arsenal). *U.S. Office of Technical Services,* PB 121551, Feb. 1955, 68 p. $1.75.

Successful application of ultrasonic soldering techniques to the difficult task of soldering aluminum. Factors significant to ultrasonic soldering, particularly the ultrasonic exposure time and soldering temperature relationships. Effects of joint configuration and filler metal thickness on joint strength. (K7h; Al)

193-K. Further Studies on Stainless Steel Hot Cracking. P. P. Puzak and H. Rischall. Naval Research Laboratory. *U.S. Office of Technical Services,* PB 121569, Nov. 1956, 12 p. $0.50.

Sporadic base-metal hot cracking and weld-metal hot cracking are generally encountered in the welding of heavy sections of the columbium-bearing Type-347 stainless steels. Results of this research support a hypothesis drawn from earlier studies that grain-boundary liquation is responsible for base-metal hot cracking. (K9n; SS, 9-22)

194-K. Joining of Molybdenum. W. N. Platte. Wright Air Development Center. *U.S. Office of Technical Services,* Technical Report 54-17, Pt. 3. Nov. 1956. (PB 121845) 85 p.

Using argon or helium permits little contamination in fusion-welding molybdenum. The use of high-purity argon shows little improvement over the welding grade. Increasing the carbon content of molybdenum in the range 0.4-0.6% improves weld ductility; the improvement of other mechanical properties by overaging and polygonization was studied. Removing nitrogen from the weld by diffusion and the effects of residual welding stresses were explored. (K1d, Q general; Mo)

195-K. Design and Technique Requirements for Arc Welding Titanium in Aircraft Applications. R. Meredith and B. L. Baird. *Welding Journal,* v. 36, Apr. 1957, p. 371-377. (CMA)

The benefits of using copper chill bars clamped on tightly in welding titanium. The weldability of titanium alloys is discussed: titanium and Ti-5Al-2.5Sn may be readily welded, Ti-3Mn-1Al and Ti-6Al-4V sheet may be welded with proper technique, and Ti-6Al-4V bar, Ti-3Al-5Cr and Ti-4Mn-4Al cannot yet be welded satisfactorily. Preweld cleaning and vacuum annealing, tooling considerations and design of butt, corner, "attach fitting", flange and special joints are also discussed. Accessibility should be provided for both sides of the joint after final assembly. (K1, T24; Ti)

196-K. Argon-Arc Welding and Post-Weld Treatment of an Aluminium-Magnesium-Zinc Alloy. W. T. Tyler, C. A. Terry and D. C. Moore.

Welding and Metal Fabrication, v. 25, Mar. 1957, p. 82-90.

High-quality butt welds produced in annealed or heat treated alloy by both manual and automatic argon shielded tungsten arc processes; effect on mechanical properties and microstructure of use of filler wire containing titanium, hot working by rolling or hammering following welding or soaking at solution heat treatment temperature.
(K1d, K9q; Al, *Mg, Zn*)

197-K. (French.) **Application of Argon Arc Welding to the Construction of Light Alloy Cars.** G. Dupré. *Soudage et Techniques Connexes,* v. 11, Jan.-Feb. 1957, p. 29-38.

Survey of the reasons for the extensive application of inert-gas arc welding using a consumable electrode; description of preliminary tests and conclusions derived as regards the selection of the welding variables; examination of the structure of some prefabricated components and the butt welding of plates. Comparison between welding and riveting. (K1d; Al)

198-K. (French.) **Productivity in the Welding of Pipelines.** C. Deutsch. *Soudage et Techniques Connexes,* v. 11, Jan-Feb. 1957, p. 57-61.

Advantages of the transport by pipeline of hydrocarbons have been confirmed by developments regarding the specifications applicable to tubes, the fabrication of welded tubes and the construction of pipelines by welding; consideration of costs and applications. (K general; 4-10)

199-K. (German.) **Inquiry Into the Applicability of the Copper-Phosphorus Solder, L Cu P 8.** Erich Luder. *Neue Hütte,* v. 2, Jan. 1957, p. 18-23.

Properties of copper-phosphorus solder; measurement of working temperatures; structure determination of the bonds; tensile tests of soldered wires; brazing of steel, nickel, copper alloys; estimation of strength of bonds; measurement of the working temperatures as a means of flux estimation. (K8; Cu, SGA-f)

200-K. (Spanish.) **Quantity Production With Brazing.** G. M. A. Blanc and J. C. Charton. *Ciencia y Técnica de la Soldadura,* v. 7, Jan-Feb. 1957, 12 p.

Influence of modern brazing procedures on cost and productivity; relation of cost to fusion time for a number of filler metals; examples of brazed joints made with blowpipes, gas flame, furnace and high-frequency current as sources of heat. (K8)

201-K. (Spanish.) **Welding. Electric Arc Welding.** *Ciencia y Técnica de la Soldadura,* v. 7, Jan.-Feb. 1957, p. 33-36.

Includes end of Chapter V on Thermodynamic Emission and Chapter VI on Impact Ionization of Atoms of Gases. (To be continued.)
(K1, P12)

202-K. (Swedish.) **Welding or Casting.** B. Wetterström and E. Gladh. *Gjuteriet,* v. 47, Mar. 1957, p. 37-41.

Discussion by an engineer and a foundryman on the design of a 68-ton steam turbine casing. New developments in welding have made welding of such casings economical; however, there have also been important refinements in casting techniques. (K general, W11, 17-1)

203-K. Fundamentals of Glass-to-Metal Bonding: Pt. II. Reactions of Tantalum and Sodium Silicate Glass. Stephan P. Mitoff. *American Ceramic Society, Journal,* v. 40, Apr. 1957, p. 118-120.

The identification of a reaction product (sodium metaniobate) at the interface between a tantalum metal and sodium silicate glass followed by thermodynamic calculations and finally testing of the calculations with further experimental evidence have been employed in this sequence to determine the most likely reaction occurring at high temperatures.
(K11a; Ta)

204-K. How to Use Nickel-Manganese Brazing. R. A. Gustafson. *Industry and Welding,* v. 30, Apr. 1957, p. 82-87.

Nickel-manganese available in wire and powder forms gives better results than nickel-chromium alloys in brazing most types of steel, including stainless steel and cobalt-base alloys. (K8; SS, Co, SGA-f, Ni, Mn)

205-K. Successful Soft Soldering of Stainless Steels. *Industry and Welding,* v. 30, Apr. 1957, p. 76-78, and 116-117.

Steps in surface preparation, solder selection, design of joints and post joining operation cleaning.
(K7; SS)

206-K. Sealing Metal and Ceramic Parts by Forming Reactive Alloys. J. E. Beggs. *Institute of Radio Engineers, Professional Group on Component Parts, Transactions,* v. 4, Mar. 1957, p. 28-31. (CMA)

Metal and ceramic parts may be sealed by inserting a thin sheet of metal that will form a reactive alloy. Titanium and copper or nickel can form such an alloy. If a shim of titanium is placed between the nickel or copper part and the ceramic part and then heated, eutectic alloys will form as indicated by the phase diagram shown. The amount of alloy which forms depends on shim thickness and the metals chosen. When the metal part is titanium it may be sealed with a nickel shim, or with solder. Metals such as molybdenum require two shims. The shim metal reacts also with the ceramic (zircon or alumina). The seals are capable of operation at high temperatures.
(K11b; Ti, Mo, Cu, Ni)

207-K. Recent Advances in the Application of Resistance Welding to Airframe Construction. N. K. Gardner. *Institution of Production Engineers Journal,* v. 36, Apr. 1957, p. 238-252.

Examples of the use of spot, seam and resistance welding; design, control and inspection. 12 ref.
(K3, T24a)

208-K. Distortion and Residual Stress in Welded Units. A. Lawless. *Mechanical World and Engineering Record,* v. 137, Apr. 1957, p. 159-163.

A summary of current practice examined in relation to a basic principle which enables an appreciation to be built up of the behavior of most structures during welding. Notes are included on some other workshop uses of controlled heat distortion. (K general, Q25k; 9-24)

209-K. How to Solder Stainless Steel. G. W. Hinkle. *Metal Products Manufacturing,* v. 14, Apr. 1957, p. 64-65.

Brief notes on preparation of stainless steel surfaces and selection of solder for making the best joint.
(K7; SS)

210-K. Hand Soldering and Brazing. *National Safety News.* v. 75, Apr. 1957, p. 34-40.

Brief notes on soldering methods such as electric iron soldering, gas-heated iron soldering, dip tinning and torch soldering. (K7, K8)

211-K. Welding Light-Gauge Mild Steel. C. R. Thatcher. *Sheet Metal Industries,* v. 34, Apr. 1957, p. 263-266.

An account of arc welding practices at Frigidaire Division of General Motors. (K1; CN, 4-3)

212-K. Brazing Stainless Steel Honeycombs. G. Jewett Crites. *Steel,* v. 140, Apr. 8, 1957, p. 92-94.

Outlines brazing alloys and several methods. Retort most widely used but vacuum furnace brazing shows considerable promise.
(K8, 1-23; SS, 7-9)

213-K. Welding and Brazing Refractory Metals. Pt. I. F. G. Cox. *Steel Processing and Conversion,* v. 43, Mar. 1957, p. 147-152. (CMA)

Use of the fabricated part is the major consideration in choosing the joining method for zirconium, molybdenum and other refractory metals. Sheet thickness is an important criterion for most methods. Zirconium sheet thinner than 0.015 in. can be suitably welded by resistance methods and not by argon arc methods. The reverse is true above that gage. Argon or vacuum is necessary for brazing. Molybdenum in all gages can be brazed by five methods and can also be resistance welded, but argon-arc welding is unsatisfactory.
(K1, K3, K8; Zr, Mo)

214-K. Discussion of the Design of Riveted and Bolted Joints in Titanium Sheet. S. A. Gordon. Battelle Memorial Institute, Report 35. *U.S. Office of Technical Services,* PB 121611, Feb. 1956, 31 p. (CMA)

A number of zirconium alloys were studied. Additives include molybdenum, tantalum, tungsten, tin, titanium and nitrogen. All but tungsten increase the high-temperature tensile strength. Tin and molybdenum increase the corrosion resistance. Some proportion of all additives except nitrogen form solid solutions and are not amenable to improvement by heat treatment.
(K13n, K13p, Q27a, R general, 2-12, 1-10, Zr)

215-K. Welding of Titanium and Titanium Alloys. G. E. Faulkner, W. J. Lewis, M. L. Kohn and P. J. Reippel. Battelle Memorial Institute, Report 31. *U.S. Office of Technical Services,* PB 121609, Feb. 1956, 82 p. (CMA)

Literature survey of welding of titanium and titanium alloys is presented with technical journal and government and industry research reports used as sources. Welding procedures are discussed. Mechanical properties of welded joints in titanium are always affected by impurities but high-purity joints are ductile and arc welded butt joints have properties like those of base metal. Methods of evaluating mechanical properties in weld joints are described. (K general; Ti)

216-K. Automatic Weld Set-Up Eliminates Distortion in Stainless Screws. F. T. Tancula. *Welding Engineer,* v. 42, Apr. 1957, p. 39-40.

Conveyor screws of Type-316 stainless steel automatically arc welded using argon shielding gas (MIG process). (K1d, T7; SS)

217-K. Automatic Tig Welding of Aluminum Fuel Tanks. J. R. McFarland and H. S. Davis. *Welding Engineer,* v. 42, Apr. 1957, p. 41.

Procedure in welding tanks for jet-propelled missiles. (K1d; Al)

218-K. Versatility and Economy. Pt. 2. Factors That Favor Acetylene.

J. Okladek. *Welding Engineer,* v. 42, Apr. 1957, p. 52-54.

Data on acetylene and propane used as cutting and welding fuels. Radiation transfer, oxygen consumption and other factors favor acetylene. (K2h)

219-K. Arc Welding Defined. Pt. 2. Consider Loading When Selecting Joint Design. Bela M. Ronay. *Welding Engineer,* v. 42, Apr. 1957, p. 55-57.

Basic essentials in designing joints to be welded, including consideration of amount and nature of load; prevention of unfused centers, good end preparation and fit-up. (K1, 17-1)

220-K. Invaluable Welds for the Auto Industry. John F. Cantalin. *Welding Engineer,* v. 42, Apr. 1957, p. 62-67.

Description of roller spot welder used in joining automobile roof flange to drip-molding. (K3n; T21)

221-K. How to Estimate Electrode Consumption (Manual or Automatic). *Welding Engineer,* v. 42, Apr. 1957, p. 95-96.

Charts for calculating approximate amounts of electrodes used for all joints. (K1)

222-K. Technology of Arc Welding of Light-Gage Sheet Steel in a Carbon Dioxide Atmosphere. F. E. Tret'yakov. *Henry Brutcher Translation* no. 3779, 3 p. (From *Svarochnoe Proizvodstov,* no. 5, May 1956, p. 20-22.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 323-K, 1956. (K1, AY, SS)

223-K. (French.) **English Production of Welding Equipment.** *Metallurgie et la Construction Mecanique,* v. 89, Mar. 1957, p. 243-247.

Gas-cutting apparatus; welding stations; electrodes; weld control and inspection. (K general, 1-2)

224-K. (French and German.) **Fresh Light on Phenomena in Inert-Gas-Shielded Arc Welding With Fusible Electrodes.** B. Keel. *Zeitschrift für Schweisstechnik,* no. 4, Apr. 1957, p. 86-89.

Analysis of the various factors involved in electrode activation; emissive potentials of various base metals; theory that by the addition of activating agents the distribution of heat in the electric arc can be regulated. (K1d)

225-K. (French and German,) **International Specifications for Filler Metals in Braze Welding.** G. M. Blanc. *Zeitschrift für Schweisstechnik,* no. Apr. 4, 1957, p. 97-99.

Determination of the adhesive characteristics on cast iron; types of assembly and choice of filler metal; operating conditions; mode of operation; testing; determination of the adhesive characteristics on metals other than cast iron and steel. (K 8, S22)

226-K. (German.) **Sheet Construction of the "Sandwich" Type.** E. W. Pleines. *Metall,* v. 11, Mar. 1957, p. 209-216.

Components of a sandwich structure are two fairly thin parallel or concentric "face", or "cover plates", with a relatively thick "core material" or "filler" which is cemented to the two cover plates. The filler can be a honeycomb, a corrugated sheet, a foam or a fiber material. Description of different applications. (K11; 7-9)

227-K. (German.) **Testing Weldability.** P. Bettziehe. *Schweissen und Schneiden,* v. 9, Mar. 1957, p. 91-93.

Factors influencing weldability and possibilities of reducing the tendency to brittle fracture. 12 ref. (K9s, Q26s)

228-K. (German.) **Increase of Strength of Soldered Joints by Decreasing the Slot Width Is Manifested as Strength Through Inhibited Deformation.** Hans Bühler and Jacob Colbus. *Zeitschrift für Metallkunde,* v. 48, Feb. 1947, p. 66-71.

With solders (Armco-iron, tin and lead) at a slot width of zero, the extrapolated values of the strength of the soldered joint depends upon the cohesive strength of the solder. The increase in strength is also dependent upon changes in the condition of stress. 20 ref. (K7; Fe, Sn, Pb, SGA-f)

229-K. (Italian.) **Nickel and High-Nickel Alloys for Pressure Vessels. Pt. III.** *Il Nickel,* no. 66, Feb. 1957, p. 7-15.

Types of welding suitable for pressure vessels; brazing; joining dissimilar metals; inspection. (Concluded.) (K general, T26q; Ni)

230-K. (Italian.) **Study on Automatic Submerged Arc Welding.** Antonio Lo Giudice. *Ingegneria Meccanica,* v. 5, Feb. 1956, p. 5-13.

Study conducted to establish limits of applicability of this technique to bodies subjected to pressure and tested by radiographic and mechanical means. (K1e)

231-K. (Italian.) **Pipe Welding. Pt. IV.** Carlo Losito. *Rivista di Meccanica,* no. 150, Dec. 1, 1956, p. 17-22.

Defects, corrective measures. (K general; 4-10, 9)

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232-K. (Spanish.) **Definitions and Recommendations Dealing With Brazing, Soldering and Welding With Bronze.** *Ciencia y Técnica de la Soldadura,* v. 7, Jan-Feb. 1957, 2 p.

Document 1-34-56 issued by Commission on Gas Welding and Allied Processes of International Institute of Welding. English, French, German and Spanish terms for wetting, spreading, flowing and strength of bond. (K7, K8, 11-17)

233-K. (Pamphlet—Multilingual.) **Multilingual Collection of Terms for Welding and Allied Processes.** Prepared by International Institute of Welding and published with financial assistance of UNESCO. 132 p. 1955. Société Suisse de l'Acetylene, Basel, Switzerland. $8.

General terms, welding procedure, characteristics and inspection of welds. In Danish, Dutch, English, Finnish, French, German, Italian, Norwegian, Serbo-Croatian, Slovenian, Spanish, Swedish. (K general, 11-17)

234-K. (Book.) **Symposium on Solder.** Fred F. Van Atta. 190 p. Apr. 18, 1957. American Society for Testing Materials, ASTM Special Technical Publication STP 189. $3.

Vital role of fluxes, solder compositions and applications in attaining satisfactory service performance of soldered joints. Covers manual, mechanized and ultrasonic techniques of soldering, and emphasizes the role of standardization in solder technology. A unique system is presented for evaluating fluxes, solder alloys and solderability in numerical terms. (K7; SGA-f)

Cleaning Coating and Finishing

195-L. Fifty Years of Mechanical Wire Descaling. P. Ewald. *Draht* (English Edition), no. 27, Feb. 1957, p. 29-33.

Fifty-year development of descaling machines and lubricants; descriptions of current European equipment. (L10g, 1-2)

196-L. Electroless Nickel Plating for Making Ohmic Contacts to Silicon. Miles V. Sullivan and John H. Eigler. *Electrochemical Society Journal,* v. 104, April 1957, p. 226-230.

A technique whereby an adherent plate of nickel may be deposited on silicon for use as an electrical contact. The contact may be used on either n or p-type silicon. 11 ref. (L28; Si, *Ni,* SGA-r)

197-L. Anodic Formation of Oxide Films on Silicon. P. F. Schmidt and W. Michel. *Electrochemical Society Journal,* v. 104, Apr. 1957, p. 230-236.

Dense oxide films have been formed anodically on p and n-type single crystal silicon in connection with the electrical properties of silicon surfaces. Concentrated nitric acid or phosphoric acid permits forming, but the highest voltage obtainable is less than 200 volts. A solution of potassium nitric acid in N-methylacetamide permits forming to 560 volts and is also preferable in other respects. 26 ref. (L19, P15; Si, 14-11)

198-L. Hot-Dip Galvanizing Cast Iron. *Foundry Trade Journal,* v. 102, Feb. 21, 1957, p. 249.

Surface preparation, fluxing, zinc bath and galvanizing. (L16; CI, *Zn*)

199-L. Automatic Setup Sprays Enamel-on-Aluminum Tile. Charles J. Jensen. *Industrial Finishing,* v. 33, Mar. 1957, p. 24-28.

Processing line for spraying porcelain enamel on both sides of aluminum tile. (L27, 18-24; Al)

200-L. Using Burn-Off Ovens to Dry-Clean Metal Surfaces. P. C. Bardin. *Industrial Finishing,* v. 33, Mar. 1957, p. 40-48.

Thermal degreasing economical for many light ferrous and a few nonferrous fabrications; convection or infrared ovens successfully remove light grease on parts not subject to distortion and give parts protective oxide coatings. (L12p, W4)

201-L. Chrome-Alloying. *Machinery Market,* no. 2938, Mar. 8, 1957, p. 27-32.

Chrome-alloying is a finishing process in which the surface of the other metals is penetrated by the chromium to form an alloy. Brief summary of the application of the process, its uses and advantages. (L15; *Cr*)

202-L. Phosphate Coatings. S. Spring. *Organic Finishing,* v. 18, Mar. 1957, p. 4-8.

Types of phosphate coatings for improving paint adhesion and reducing corrosion of metal surfaces; methods of application, bath composition and analysis and control of coating characteristics. (L14b)

203-L. Oil Removal With Heat. John E. Hyler. *Organic Finishing,* v. 18, Mar. 1957, p. 19-21.

Degreasing cold rolled sheet, wire coat hangers and other metal fabrications by vaporization of oil in burn-off oven of convection or infrared radiant types. (L10g, W4)

204-L. Metal Pretreatment and Its Effect on the Performance of Metallic Lead Primers. C. D. Coppard. *Paint Technology,* v. 21, Mar. 1957, p. 89-90.

Tests for evaluating pretreatments; service conditions; proven paints and lead primers were used. Results described. (L26n)

205-L. A Completely Automatic Finishing Department. *Precision Metal Molding,* v. 15, Mar. 1957, p. 74-75.

Precision Castings Co. has installed a new and very extensive finishing line capable of cleaning, buffing, polishing, chemical coating, painting and baking.
(L general, 18-24)

206-L. Finishing of Small Gears by Electrolytic Polishing. Electrolytic Finishing of Gears and Changes in Their Shapes. Masao Naruse and Akira Nannicki. *Tohoku University, Technology Reports,* v. 21, no. 1, 1956, p. 107-116.

Electrolytic polishing as a means of precision finishing the teeth of small gears that have been cut by machine. (L13p, T7a)

207-L. (French.) **New Method for the Rapid Electrolytic Polishing of Surfaces and Its Metallographic Applications.** Pierre A. Jacquet. *Comptes Rendus,* v. 243, Dec. 17, 1956, p. 2068-2071.

A very simple apparatus comprising a cathode surrounded by spongy, insulating fabric permits either local or complete polishing of samples of metals and common alloys. The provision of a high degree of polish justifies the general use of this technique, originally intended for nondestructive metallographic examination. 4 ref. (L13p, M20p)

208-L. (French.) **Tendency to Automation for Protective Coatings by Chemical and Electrical Methods.** P. Orlowski. *Pratique des Industries Mécaniques,* v. 40, Jan. 1957, p. 14-15.

Survey of various types of automatic installations for chemical and electrolytic treatments allowing the constant regulation of temperature, regular filtration of the baths and precise control of the immersion time. (L general, 18-24)

209-L. (French.) **Improvement of Corrosion Resistance by Chemical Processes.** J. Meynis de Paulin. *Pratiques des Industries Mécaniques,* v. 40, Jan. 1957, p. 16-18.

Advantages of chemical deposition; methods of degreasing; phosphating of ferrous metals; uses of phosphate coatings; chemical and anodic oxidation of light metals; galvanic protection of magnesium; chemical deposition of nickel. (L general)

210-L. (French.) **Practical Methods for the Finishing of Stainless Steel Pieces.** *Revue Générale de Mécanique,* v. 41, Jan. 1957, p. 37-39.

Mill finishes; mechanical and chemical treatments; current methods of cleaning, scouring, polishing and electrolytic surface treatments. (L general; SS)

211-L. (German.) **Galvanizing of Bolts and Nuts and Small Parts. Pt. 2.** W. Peters. *Draht,* v. 8, Feb. 1957, p. 40-48.

Modern machines for galvanizing of small parts; high-performance electrolytes; nickel plating; nickel plating without current; brass, zinc, cadmium and chromium plating; after-treatment; inactivation of bolts. (L16, L17, 1-2, T7; *Zn*)

212-L. (German.) **Thixotropic Coating on Metals.** Shigeto Yamaguchi. *Kolloid Zeitschrift,* v. 149, Dec. 1956, p. 125-126.

If a thixotropic sol-gel protective layer is subjected to long periods of inactivity, irreversible alterations cause deterioration. 2 ref. (L27)

213-L. (German.) **Mechanical Descaling, Particularly Descaling by Bending, in the Processing of Steel Wire.** Clemens Eisenhuth. *Stahl und Eisen,* v. 77, Mar. 21, 1957, p. 323-334.

Present status of descaling by bending; joint tests: execution and results of the tests; single tests; characteristics of the scale and lubricants; design of the drawing tools; cleaning effect of the descaling machines used. (L10g; ST, 4-11)

214-L. (German.) **Behavior of Copper in Steel During Scaling and Its Effect on the Hot-Dip Zinc Coating of Steel Wires.** Clemens Eisenhuth, Wolfgang Gruhl, Werner Papsdorf and Irmgard Eisenhuth. *Stahl und Eisen,* v. 77, Mar. 21, 1957, p. 354-359.

Investigation of the copper distribution in steel specimens containing 0.70% C and 0.38% Cu in relation to the degree of scaling; behavior of copper when annealing in an argon atmosphere; effect of molten zinc on the copper content in the marginal zone.
(L16, J23; ST, *Zn, Cu,* 4-11, 92)

215-L. (Portuguese.) **Electrolytic Tin-Plating in the Volta Redonda Mill.** Pedro Silva. *A B M, Bulletin of the Brazilian Metals Society,* v. 45, Oct. 1956, p. 331-354.

Equipment, process details, tests. 5 ref. (L17, 1-2; *Sn*)

216-L. Nickel Plating by Chemical Reduction. *Design Engineering,* v. 3, Apr. 1957, p. 59-61.

The Kanigen nickel plating process for applying a nickel-phosphorus coating to metals without electricity. (L28; *Ni*)

217-L. Limitations of Plated Nickel in Jet Engine Design. R. W. Moeller and W. A. Snell. *Electroplating and Metal Finishing,* v. 10, Mar. 1957, p. 74-77.

Properties of nickel plated on steel from watt type, sulphamate and chemical nickel solutions include information on residual stress versus temperature; residual stress versus fatigue life and plate thickness versus corrosion resistance.
(L17C, Q25h; *Ni*)

218-L. Properties of Sprayed Zinc Coating. E. Gebhardt and H. D. Seghezzi. *Electroplating and Metal Finishing,* v. 10, Mar. 1957, p. 81-85.

Experimental values for tensile strength, hardness, impact resistance and electrical conductivity. Effect of spraying method and coating thickness on properties.
(L23, Q general, P15g; *Zn*)

219-L. The Extending Field for Vapour Blasting. *Machinery,* v. 90, Mar. 8, 1957, p. 508-515.

Covers principles of vapor blasting, standard and specialized equipment and detachments. (L10c, 1-3)

220-L. Vinyl Coatings for Metal Products. R. A. Calsibet. *Materials and Methods,* v. 45, Mar. 1957, p. 130-134.

Properties, methods of application and uses of vinyl coatings of work primer, solution and dispersion types. (L26p)

221-L. Fundamentals of Barrel Finishing. Pt. 1. Equipment and Methods. T. W. Black. *Tool Engineer,* v. 38, Apr. 1957, p. 109-118.

General report on principles, types of barrels, media, compound and other variables influencing finishes obtained. (To be continued.) (L10d)

222-L. Automatic Zinc Spraying of Steel Drums. G. A. Curson. *Welding and Metal Fabrication,* v. 25, Mar. 1957, p. 78-81.

Equipment for automatic spraying of zinc powder; sequence of operations and advantages.
(L23, 1-3; ST, *Zn*)

223-L. How to Finish Stainless Steel. Richard E. Paret. *Western Machinery and Steel World,* v. 48, Mar. 1957, p. 102-109.

Selection and protection of mill finishes; procedures and precautions in carrying out grinding, polishing, buffing, barrel finishing, embossing, mechanical and chemical etching, electropolishing, pickling, plating and enameling operations on stainless steel sheets and parts.
(L general; SS)

224-L. (German.) **Chromium-Iron-Nickel Alloys Resistant to Abrasion at High Temperatures.** G. Faber. *Schweizer Archiv,* v. 23, Jan. 1957, p. 14-19.

Sigma phase of iron-chromium alloys as a hardening agent. Two types of surface films are used, a coating produced by a blow torch using the alloy in question as filler metal and a chromium-enriched surface obtained by diffusion in an appropriate steel. 6 ref.
(L16; Cr, Ni, Fe, SGA-m, 2-12)

225-L. (Italian.) **Zinc Powder Base Protective Paints.** *Machine,* v. 12, Feb. 1957, p. 94-97.

Problems of corrosion of iron; use of zinc-base paints in place of galvanizing, metallizing, etc.; properties of such paints. (L26n; *Zn*)

226-L. (Italian.) **Phosphatization of Ferrous Metals.** Bonanno Bonanni. *Macchine,* v. 12, Feb. 1957, p. 161-169.

Purpose of phosphate, coatings, process cycle, types of equipment, costs. (L14b)

227-L. (Japanese.) **The Electrochemical Properties of Titanium—Pt. 3. Electrodeposition of Titanium and Its Use.** S. Morioka, T. Shibata and A. Umezono. *Japan Institute of Metals, Journal,* v. 21, Jan. 1957, p. 32-35. (CMA)

An electrolytic titanium powder is deposited from $(NH_4)_2TiF_6$-water solutions. It is black, fine, active and readily covered with an oxide film at 25° C. This film is thin, stable at high temperatures and nonconductive, thus lending itself to use as an insulating material in magnetic cores. (L17, T1; Ti)

228-L. Sprayed Metal as a Base for Paints. H. S. Ingham. *Corrosion,* v. 13, Apr. 1957, p. 44-48.

Uses of thin metallized coating of zinc or aluminum on steel. Selection, application and performance of paints applied to sprayed metal surfaces. (L23, L26n; ST, *Zn, Al*)

229-L. Electroplating for the Electronics Industry. D. J. Fishlock. *Electrical Journal,* v. 158, Mar. 15, 1957, p. 750-755.

Mechanisms of plating including Dalic plating; description of modern electroplating equipment. Mechanical properties of deposited nickel, chromium, rhodium and tin. 14 ref.
(L17, 1-2, Q general; *Ni, Cr, Rh, Sn*)

230-L. Electrodeposition From Sulphamate Solutions. Pt. 4. Cadmium. J. Mathur and T. L. Rama Char. *India Section the Electrochemical Society, Bulletin,* v. 6, Jan. 1957, p. 6-10.

The optimum conditions have been established for the electrodeposition of cadmium from the sulphamate bath. Its performance is satisfactory over a wide range of experimental conditions. 13 ref. (L17a; Cd)

231-L. Anodic Behaviour of Copper in Aqueous Solutions. Donald J. Royer, Jacob Kleinberg and Arthur W. Davidson. *Journal of Inorganic and Nuclear Chemistry,* v. 4, Mar. 1957, p. 115-127.

The anodic oxidation of copper in a variety of aqueous electrolytes has been investigated. In the presence of agents (e.g., cyanide, chloride, sulphate ions) which form stable complexes with copper (I) the metal enters solution solely in the unipositive state over a wide concentration range of electrolyte.
(L19, P12e; Cu)

232-L. Electrodeposition From Sulphamate Solutions. Pt. 1. Nickel. S. Sathyanarayana and T. L. Rama Char. *Journal of Scientific and Industrial Research,* v. 16 A, Feb. 1957, p. 78-85.

The sulphamate bath has been found to be satisfactory for the plating of nickel. It gives good quality deposits over a wide range of experimental conditions and is comparable to the sulphate bath. 30 ref. (L17a; *Ni*)

233-L. Electrodeposition From Sulphamate Solutions. Pt. 2. Zinc. S. Sathyanarayana and T. L. Rama Char. *Journal of Scientific and Industrial Research,* v. 16A, Feb. 1957, p. 86-90.

Optimum conditions have been established for the electrodeposition of zinc from the sulphamate bath. The bath is comparable in performance to the sulphate bath. 18 ref. (L17a; Zn)

234-L. Proper Cleaning Methods Pay Dividends. Lester F. Spencer. *Metal Finishing,* v. 55, Apr. 1957, p. 56-61.

Factors determining efficiency of metal cleaning operation are the cleansing agent, method of procedure and equipment. Suggestions for selections. (L12)

235-L. Coatings for Protection of Electroplating Equipment. Michael Perze. *Metal Finishing,* v. 55, Apr. 1957, p. 62-64.

Notes on properties and application of coatings available for protecting plating equipment including rubber sheeting, hot dip coating such as waxes, solvent-type coatings and plastisols. (L26p, L26q, L26r, W3)

236-L. Surface Treatment and Finishing of Light Metals. Pt. 12-D. Plating on Aluminum — the Vogt Process. S. Wernick and R. Pinner. *Metal Finishing,* v. 55, Apr. 1957, p. 68-71.

Preparatory treatment and plating sequence consisting of zinc, brass, nickel and chromium plating on aluminum hollow-ware and heat treatment following nickel and chromium plating for Vogt process and its modifications. (L17; Al, *Ni, Cr*)

237-L. Science for Electroplaters. Pt. 23. Chemical Surface Preparation. L. Serota. *Metal Finishing,* v. 55, Apr. 1957, p. 72-73.

Discussion of alkaline cleaning and surface active agents includes soap tank and electrolytic cleaning baths. (L12k, L13n)

238-L. Finishing Supplement. Pt. 3. Degreasing. *Metal Industry,* v. 90, Mar. 22, 1957, p. 229-231.

Informal discussion held by Institute of Metals about the use of trichlorethylene and ultrasonic cleaning for metal surfaces. (L12h, L10f)

239-L. Electroplating of Zinc Die Casting. Earnest Hornvich. *Metal Products Manufacturing,* v. 14, Apr. 1957, p. 68-70.

Purpose of electroplating, cleaning the castings, determining the optimum coating thickness.
(L17; Zn, 5-11)

240-L. How Lining With Inconel Combats Digester Corrosion. J. F. Nation and J. M. Tull. *Paper Industry,* v. 39, Apr. 1957, p. 33-36.

Use of Inconel cladding in pulp industry for corrosion resistance; techniques of Inconel lining and results. (L22, T29r; Ni)

241-L. How to Care for Stainless Steel. James H. Hunter. *Textile Industries.* v. 121, Mar. 1957, p. 124-125.

Stainless steel maintenance problems are enumerated and corrective steps suggested. (L12, 18-21; SS)

242-L. Ultrasound Cleaning With Magnetostrictive Vibrators. H. J. Gollmick and K. Tesser. *Henry Brutcher Translation* no. 3828, 5 p. (From *Metalloberfläche,* v. 10, no. 8, 1956, p. 233-237.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 644-L, 1956. (L10)

243-L. (French.) **Method for the Treatment of Corrosion of the Surface of Magnesium Castings—Some Preliminary Results on the HAE Method.** G. Nordell and I. Weibull. *Corrosion et Anticorrosion,* v. 5, Feb. 1957, p. 58-60.

Explains a new coating for magnesium already in use in the United States. Equipment and method of treatment; effect of the anodic (HAE) coating on fatigue strength. 4 ref. (L19, 1-3, Q7a; Mg, 5)

244-L. (French.) **Plastic, Protective Bands Used Against Corrosion.** Werner Kirsch and Lucien Remy. *Corrosion et Anticorrosion,* v. 5, Mar. 1957, p. 82-88.

This easily applied form of protection presents a particular interest in the case of buried metal piping. Several varieties of bands are described—in natural fibers, glass fiber and synthetic materials; outlines applications and behavior characteristics. (L26p, R8; 4-10)

245-L. (French.) **Preparation Before Electroplating of Die-Cast Zinc Parts.** *Galvano,* no. 242, Mar. 1957, p. 21-24.

Determination and performance of preparatory processes before electroplating of zinc castings conforming to ASTM B86 and ASTM B142. Electrolytic deposits of nickel and chromium on zinc and zinc-base alloys are discussed.
(L17, L10, L12; Zn, 5-11)

246-L. (French.) **Choice, Control and Use of Bright Nickel Plating Solutions.** *Galvano,* no. 242, Mar. 1957, p. 29-34.

Differences in technique for achieving bright and dull nickel finishes; types of fully bright and semibright solutions; control of the principal constituents of the baths; consideration of the cleaning cycle. (To be continued.) (L17a; *Ni*)

247-L. (French.) **A Surface Treatment Plant.** *Galvano,* no. 242, Mar. 1957, p. 35-37.

Layout and operations of the Modern Plating Co.'s plant at Los Angeles. (L17, 18-17)

248-L. (French.) **Silver Plating and Gilding of Zamak.** *Galvano,* no. 242, Mar. 1957, p. 39-40.

Notes the excellent market for die-cast Zamak articles such as paper knives; discusses the extensive possibilities offered for the coating of zinc alloy die castings with precious metals; outlines processes involved—casting, degreasing, silvering, gilding and types of baths used. (L17; Zn, *Ag, Au,* 5-11)

249-L. (French.) **Galvanizing by the Continuous Process.** *Metallurgie et la Construction Mecanique,* v. 89, Mar. 1957, p. 249-251.

Outline of the Sendzimir process and the equipment involved; heat treatment of sheet iron; chemical reactions; working procedures.
(L16, 1-11, F23; Fe, Zn)

250-L. (French.) **Surface Treatment of Aluminum and Its Alloys. Pt. III. Electrolytic Treatments—Anodic Oxidation Processes Other Than the Sulphuric Process.** Charles Etienne and Francois Flusin. *Revue de l'Aluminium,* no. 241, Mar. 1957, p. 295-301.

The oxide-dissolution equilibrium which, for a given electrolyte, governs the conditions of the electrolysis (concentration, temperature, current density, time) can be modified by a change in the nature of the electrolyte. The oxide films thus obtained can offer special properties. Description of the electrolytes when sulphuric acid is the main constituent with additions of acetic acid, glycerin, chromic acid, magnesium chloride, oxalic acid. Chromic acid baths and oxalic acid baths.
(L19p, L19q; Al)

251-L. (German.) **Flame Cleaning.** H. Wiegand, F. Nieth and K. W. Sippell. *Metalloberfläche,* v. 11, Apr. 1957, p. 109-114.

Flame cleaning technique; determination of temperature peaks and dissipation and their dependence and importance in successful cleaning. 6 ref. (L10g)

252-L. (German.) **Flame Cleaning of Rolled Sheet Metal.** H. Wiegand, F. Nieth and W. Neuhaus. *Metalloberfläche,* v. 11, Apr. 1957, p. 114-119.

Experiments on rolled sheet of various thicknesses and composition; removal of scale in relation to composition of scale; scale and sheet thickness; scale thickness as dependent on number of passes and rolling temperature; composition dependent on sheet thickness, number of passes and casting method. 7 ref. (L10g, F23; 4-3)

253-L. (German.) **Flame Cleaning of Black Plate.** Werner Neuhaus and K. W. Sippel. *Metalloberfläche,* v. 11, Apr. 1957, p. 120-127.

Results of an acetylene-oxygen flame on 100 sheets of black plate of varying composition. 6 ref. (L10g; ST, 4-3)

254-L. (German.) **Suitability of Various Flammable Gases for Rust Removal or Flame Cleaning.** H. Wiegand and F. Nieth. *Metalloberfläche,* v. 11, Apr. 1957, p. 129-135.

Results in the use of acetylene, propane, hydrogen and illuminating gas for flame cleaning and removal of rust; amounts of gas and oxygen used; temperature gradients obtained. 8 ref. (L10g; RM-m)

255-L. (Italian.) **Use of Automatic Submerged Arc Welding in Surfacing Operations.** Oscar Grossi. *Ingegneria Meccanica,* v. 5, Nov. 1956, p. 55-63.

General nature of surfacing by this process; details of surfacing operations on crane wheels, railroad car wheels and rolling mill rolls. (L24, K1e)

256-L. (Italian.) **Ceramic Coatings for Metals Subjected to High Temperatures.** *La Ceramica,* v. 12, Jan. 1957, p. 51-53.

Problems of effect of high temperatures can be solved variously by use of special metals, cooling of affected parts, substitution of nonmetallic parts and protective coatings. Description of "Rokide" coating using alumina, zircon and oxide of zircon; comparison of characteristics of these coatings with stainless steel; applications. (L27, 2-12)

257-L. (Italian.) **Researches on the Electrochemical Behavior of Tin. Note II—Solutions Containing Fluorions.** U. Bertocci and G. Serravalle. *Metallurgia Italiana,* v. 49, Feb. 1957, p. 95-98.

The kinetic behavior of both cathodic and anodic tin in fluorhydric and fluorhydrochloric solutions investigated with regard to the formation of fluorine compounds. Study of the influence of the concentration of the complexing agent and of the acidity and temperature. 3 ref. (L17; Sn)

258-L. (Italian.) **Electrodeposition of Sn-Ni and Sn-Sb Alloys.** G. Serravalle. *Metallurgia Italiana,* v. 49, Feb. 1957, p. 99-106.

Study of the electrochemical behavior of tin, nickel and antimony in solutions containing fluorions. The electrochemical aspects of the separation of nickel, tin and tin-antimony alloys. On the basis of results obtained, an interpretation of the electrodeposition of these alloys and of their electrodic behavior has been formulated. 5 ref. (L17, C23; Sn, Ni, Sb)

259-L. (Japanese.) **Effects on the Thermal Shock Resistance of Ceramic Coating of Nickel-Flash and Mill Addition of Cobalt Oxide Fired in Nitrogen Stream.** Chihiro Kawashima and Yorihiro Murata. *Ceramic Association, Japan, Journal,* v. 60, no. 735, Mar. 1, 1957, p. 31-40.

Most effective addition is 3% CoO, since selective galvanic corrosion occurs at this content. When the galvanic corrosion of cobalt monoxide and reducing action of nickel flashing act simultaneously during enameling, these factors cancel each other so that both thermal-shock resistance and adherence strength greatly decrease. (L27, 2-10, Q10a)

260-L. (Swedish.) **Descaling in Connection With Hot Rolling.** Gunnar Nyberg. *Jernkontorets Annaler,* v. 141, no. 1, 1957, p. 37-59.

Descaling with high-pressure water spray; investigations of different types of nozzles; importance of suitable pressure and of direction of jet. (L12, F23, 1-16; ST)

261-L. (Book—French.) **Treatise on Electroplating.** J. Salauze. 819 p. 1956. Dunod, 92 Rue Bonaparte, Paris 6e, France. 5900 Fr.

Theoretical analysis of electrolytic dissociation, potentials, polarization and formation of deposits, accompanied by detailed practical discussion of baths, preparation of pieces (scouring, degreasing, etc.), equipment used, nature of coatings, protection offered against corrosion. Surveys metals ranging from silver and copper to lead, tin, nickel, zinc, aluminum and magnesium with some reference to alloys. (L17)

Metallography

Constitution and Primary Structures

148-M. Microscopical Examination of Metallic Surfaces. J. Nutting. *Discovery,* v. 18, Mar. 1957, p. 112-117.

Purposes, techniques, equipment; progress toward methods capable of revealing the smallest metal aggregate. (M21)

149-M. Measurement of Elongation of Ferrite Grain in Deep Drawing Sheet. Tetsutaro Mitsuhashi and Yuzo Hosoi. *Mechanical Laboratory of Japan, Journal,* v. 2, no. 2, 1956, p. 40-41.

Elongated grain structure of ferrite is of great importance for aluminum-killed deep drawing sheets, but there is no proper method to express the elongation of the grain. Two methods considered are the counting method and the length measuring method. (M27c, 1-4; ST-c, 4-3)

150-M. Apparatus for X-Ray Diffraction Studies of Metals Under Controlled Stresses at Elevated Temperatures. L. S. Birks. *Norelco Reporter,* v. 4, Jan-Feb. 1957, p. 8-10.

A Geiger-counter X-ray spectrometer was constructed for the dynamic study of phase changes and other phenomena in metals under controlled stress conditions at elevated temperatures. 6 ref. (M22-g, 1-3, 2-12)

151-M. Liquid Immiscibility in Metal Systems. B. W. Mott. *Philosophical Magazine,* v. 2, 8th Series, Feb. 1957, p. 259-283.

An analysis is made of liquid immiscibility in metal systems. It is shown that the simple Hildebrand rule, which holds for nonpolar liquids, can be modified to apply to metal systems, by the introduction of a new term which allows for the increased energy due to a difference in electronegativity of the components. (M24; 14-10)

152-M. Domain Patterns on Cobalt Crystals. E. O. Hall. *Physical Society, Proceedings,* v. 70, Pt. 2, Feb. 1957, p. 254-256.

A theoretical explanation of the patterns of a simplified domain structure. 7 ref. (M27g; Co)

153-M. (French.) **Diffraction of Electrons by Small Metallic Crystals.** Lucien Lafourcade and Paul Larroque. *Comptes Rendus,* v. 244, Jan. 7, 1957, p. 178-180.

Comparison of the diagrams formed on a single plate by two films of very different thickness prepared with the same metal. Measurements show that the relative displacement of the maxima of diffraction appears to depend only on the number of atoms contained in the crystal. This displacement is important only for crystals containing no more than several hundred atoms. (M22g, M26)

154-M. (French.) **On the Selective Dissolution of Iron-Chromium-Nickel Alloys.** Henri Hatwell. *Comptes Rendus,* v. 245, Jan. 14, 1957, p. 340-343.

Variation of the speed of anodic dissolution as a function of chromium content. 5 ref. (M20q, 1-10; Fe, *Cr, Ni*)

155-M. (French.) **Structure of Steel Ingot Molds, New and After Service.** Michel Ferry. *Fonderie,* no. 133, Feb. 1957, p. 55-63.

Analysis from the viewpoint of depth; variations in structure following the region examined; variations in thickness; comparison of structure before and after heat treatment. 7 ref. (M27, W19, 17-7; ST)

156-M. (French.) **Paper on the Study of Macrographic and Micrographic Structures of Gray Cast Iron for Steel Ingot Molds.** L. Beaujard and S. Bechet. *Fonderie,* no. 133, Feb. 1957, p. 80-89.

Pearlite and ferrite in cast iron molds; nonmetallic inclusions; notes that the microstructure is as much influenced by the chemical composition as by the conditions of casting and cooling. 12 ref. (M27b, M28h, W19, 17-7; CI-n)

157-M. (Russian.) **Some Properties of Zirconium-Columbium Alloys.** Yu. F. Bychkov, An. N. Rozanov and D. M. Skorov. *Atomnaya Energiya,* v. 2, Feb. 1957, p. 146-157. (CMA)

The authors plotted the phase diagram of the system zirconium-columbium. It presents a continuous series of solid solutions involving beta-zirconium and a eutectoid transformation at 560° C. and 12% Cb. The tensile strength relative elongation and hardness of the alloys were determined as a function of their composition, as well as the heat resistance, which was measured by (*a*) the changes of the hardness at temperatures up to 750° C., and (*b*) the amount of oxidation in air at 570 and 650° C. 5 ref. (M24b, Q general; Zr, Cb)

158-M. The Crystal Structure of U_2Mo. E. K. Halteman. *Acta Crystallographica,* v. 10, Mar. 10, 1957, p. 166-169. (CMA)

The crystal structure of the γ' phase in U-Mo (U_2Mo) is of the $MoSi_2$ type, has a tetragonal unit cell and lattice parameters of $a = 3.427$ Å and $c = 9.834$ Å. The γ' phase is an ordered state of the body-centered cubic γ phase. (M26q; U, Mo)

159-M. The Structure of V_4Al_{23}. J. F. Smith and A. E. Ray. *Acta Crystallographica*, v. 10, Mar. 10, 1957, p. 169-172. (CMA)

The crystal structure of V_4Al_{23} was shown by X-ray diffraction to have a hexagonal unit cell and parameters of a = 7.692 Å and c = 17.04 Å. The compound occurs in the Al-V system and is structurally related to Co_2Al_5, Fe_2NiAl_{10}, and Mn_3SiAl_9. Layering is pronounced but imperfect and zone boundaries are prominent. The Al-V bond distances are very short. (M26q; V, Al)

160-M. Fibre Texture of Drawn Face-Centered Cubic Metal Wires. P. Dayal. *Indian Institute of Metals, Transactions*, v. 8, 1954-55, p. 261-268.

Face-centered cubic metals, on being drawn into wires, deform by slipping over the (111) planes in the (110) directions. The crystal grains are so arranged that a definite crystallographic orientation lies parallel to the axis of the wire. A critical review of the known deformation textures in the face-centered cubic metal wires and of the relation between the texture and the properties has been made. (M26c, Q24a; 4-11)

161-M. Compounds in the Titanium-Rich Region of the Ti-Al System. E. Ence and H. Margolin. *Journal of Metals*, v. 9, Apr. 1957, p. 484-485. (CMA)

Titanium alloys with more than 12% aluminum were found to be brittle and the c/a ratio of the alpha-phase increases with the aluminum added. The compound Ti_3Al occurs between 20-30% aluminum and 1000-1200° C. Lattice parameters are a = 5.775 Å and c = 4.638 Å, and the structure is isomorphous with Ti_3Sn. Additional complexities have been noted in the region below Ti_2Al. (M26q; Ti, *Al*)

162-M. Simple Method of Austenite Grain Size Measurement. Tetsutaro Mitsuhashi and Yuzo Hosoi. *Mechanical Laboratory of Japan, Journal*, v. 2, no. 2, 1956, p. 38-39.

A simple method of austenite grain size measurement in steel, called the "slide method". In this method, grain size number of specimen is estimated easily in the field of the microscope eye-piece by comparing with the reduced standard grain size diagrams inserted into the front focal plane of the eye-piece. (M27c, 1-4; ST)

163-M. Preferred Orientation in Uniskanned Zirconium. W. V. Cummings and E. N. Kling. *U.S. Atomic Energy Commission*, HW-41772, Mar. 5, 1956, 66 p. (CMA)

The Uniskan process of forming thin-walled tubes is classified as a rolling process, but the shape and action of the rolls and the nature of the applied forces are unique. The preferred orientation of Uniskanned zirconium is important in predicting the performance of the finished product. X-ray diffraction was employed. The thicker walls showed random orientation but the thinner walls developed a preferred orientation quickly, which was about 10° for the angle and 5° for the angle ϕ and 5° for the angle α. X-ray intensity versus percent reduction is plotted. 4 ref. (M26c, F26s; Zr)

164-M. Tabulation, Bibliography, and Structure of Binary Intermetallic Compounds. Pt. II. Compounds of Beryllium, Magnesium and Calcium. K. A. Gschneidner, D. J. Beerntsen, R. W. Vest, J. A. Kingston and J. F. Smith. Iowa State College, *U.S. Atomic Energy Commission*, ISC-812, Dec. 27, 1956, 36 p.

The second of a series of reports on intermetallic compounds. (M26q)

165-M. (English.) Investigation of Systems of Fused Salts Based on Thorium Fluoride. V. S. Emelyanor and A. I. Evstyukhin. *Soviet Journal of Atomic Energy*, no. 4, 1956, p. 561-566. (Translated by Consultants Bureau, Inc., 227 17th St., New York, N.Y.)

The system thorium fluoride-sodium chloride-potassium chloride, which is significant in the selection of an electrolyte for the production of thorium by electrolysis, was investigated by thermal and X-ray phase-analytical methods. The salts were melted in an atmosphere of argon and the structural diagrams prepared. 9 ref. (M24d, C23p; Th)

166-M. (German.) The Metal Science of Titanium Alloys. M. Hansen. *Berg- und Huettenmaennische Monatshefte*, v. 101, Dec. 1956, p. 285-292. (CMA)

The three main types of phase diagrams of titanium alloys (Ti-Fe, Ti-Mo and Ti-Al types) described. The effects of the presence of oxygen, nitrogen, aluminum and chromium on the mechanical properties of the products are surveyed, and the nature of the phase transformation of solid solutions, due to transformations of alpha and beta titanium, is explained. (M24b, 1-10; Ti)

167-M. (German.) Phase Diagrams of Titanium-Base Systems. I. I. Kornilow. *Berg- und Huettenmaennische Monatshefte*, v. 101, Dec. 1956, p. 304-307. (CMA)

A general investigation of the mutual effects of titanium and other elements of the periodic system enabled the classification of binary titanium systems into five typical phase diagrams: (1) systems with continuous solid solutions of alpha and beta Ti; (2) systems with continuous solid solutions of beta Ti and limited solid solutions of alpha Ti; (3) systems with limited solid solutions and having a eutectoid transformation; (4) systems with limited solid solutions and having a peritectoid transformation; and (5) systems which do not form solid solutions. Examples of each type are cited and typical phase diagrams are shown. (M24b; Ti)

168-M. (German.) Structural Investigations of the Systems Titanium-Gallium and Titanium-Indium. K. Anderko. *Naturwissenschaften*, v. 44, Feb. 1957, p. 88. (CMA)

An intermediary phase Ti_2Ga was found in the system titanium-gallium crystallizing in the hexagonal system. In the system titanium-indium a phase of the composition Ti_3In, crystallizing with higher indium contents in the cubic system was found. 3 ref. (M24b; Ti, Ga, In)

169-M. (German.) Ordered Hexagonal Phases in the Systems Titanium-Aluminum and Titanium-Indium. Kurt Anderko, Konrad Sagel and Ulrich Zwicker. *Zeitschrift für Metallkunde*, v. 48, Feb. 1957, p. 57-58. (CMA)

X-ray investigations on Ti-Al, Ti-In and Ti-Al-In alloys showed the existence of the two ordered hexagonal phases Ti_3Al and Ti_3In. These two phases are isotypic and completely miscible with each other. The occurrence of an ordered α-phase Ti_3Al, isotypic with Ti_3Sn, explains the continuous mixed crystal formation between the gamma-phase Ti_3Sn and the homogeneous alpha-phase of titanium-aluminum system. Continuous mixed crystal formation may also be expected in the Ti_3In-Ti_3Sn system. 9 ref. (M24; Ti, Al, In)

170-M. (Italian.) On the Effects of Chemical Etching on Germanium Monocrystals. G. Della Pergola and D. Sette. *Nuovo Cimento*, Suppl. to v. 4, Series X, no. 2, 1956, p. 1021-1033.

Study conducted on two faces of a germanium monocrystal with (100) and (111) planes; four different etching solutions used. 8 ref. (M20q; Ge)

171-M. Lattice Defects and Plastic Deformation. L. M. Clarebrough. *Australian Institute of Metals, Journal*, v. 1, Oct. 1956, p. 90-110.

Literature review giving some of the current ideas concerning nature of dislocations and role they play in plastic deformation of metals. Materials cited include structure of dislocations including edge and screw types. Evidence from experiments on crystal growth, low angle boundaries and metallic whiskers; part played by dislocation mechanisms in plastic deformation in forming large slip steps, lattice defects and dislocations. 73 ref. (M26s, M26b, Q24)

172-M. Lattice Dynamics of Body-Centered and Face-Centered Cubic Metallic Elements. Pt. III. Cubic Invariant Polynomials. Jules De Launay. *Journal of Chemical Physics*, v. 26, Mar. 1957, p. 663-667.

When the frequencies obtained from the secular equations of lattice dynamics are expressed as power series in the magnitude of the propagation vector, the coefficients of the series terms are polynominals in the direction cosines of the vector. These polynominals are invariant under the symmetry operations of the cube. A number of their properties which have proved to be of value in computations of the lattice spectrum are presented. (M26)

173-M. Epitaxial Growth and Oxidation of Nickel, Cobalt and Iron on Rocksalt. L. E. Collins and O. S. Heavens. *Physical Society Section B, Proceedings*, v. 70, Mar. 1, 1957, p. 265-281.

The structure and orientations of films of iron, nickel and cobalt, deposited by thermal evaporation on rock salt, have been examined by electron diffraction. The oxides, forming spontaneously on the epitaxially grown metal films, have also been examined. The results are considered in the light of current theories of epitaxy and it is shown that the lattice misfit between substrate and deposit materials is generally less important than the maintenance of correct coordination of atoms in the first layer. 22 ref. (M26r; Ni, Co, Fe, 14-12)

174-M. (English.) Electron Diffraction Study on Polish Layers of Gold. Pt. I. Masao Kuriyama, Kazutake Kohra and Satio Takagi. *Physical Society of Japan, Journal*, v. 12, Feb. 1957, p. 151-156.

Line breadths were measured at various stages of polishing. The mean grain size and the mean strain

were determined using Hall's method for medium polish layers which produce broad ring patterns. The grain size was also determined from electron micrograph and from the number of spots on a spotty diffraction ring obtained from a minute region of the specimen. The values obtained from those different methods agree in order of magnitude with each other. 22 ref. (M22h; Au)

175-M. Etching Technique for Simultaneous Development of Austenite and Pearlite Structures. V. S. Popov. *Henry Brutcher Translation* no. 3891, 1 p. (From *Zavodskaya Laboratoriya*, v. 22, no. 3, 1956, p. 317.) Henry Brutcher, Altadena, Calif.

Currently used technique for etching weld joints. New etching technique permitting simultaneous development of austenitic and pearlitic structures in composite welds, clad steel, etc. (M20q; ST, 7-1)

176-M. (French.) **Radiocrystallographic Study of Hydridation of Cerium; Attempt at Interpretation, Including the Case of Lanthanum.** Claude Ayphassorho. *Comptes Rendus*, v. 244, Mar. 25, 1957, p. 1766-1769. (CMA)

Several writers have observed the size reduction of the elementary lattice cell (face-centered cube) of cerium hydride and lanthanum hydride when the amount of hydrogen absorbed in the system metal-hydrogen increases. This change has been ascribed to the existence of two cubic lattices. The present author, examining the system Ce-H with the aid of the neutron spectrographic method at 350° C. and at room temperature, arrived at the following interpretation (which probably also applies to the system La-H); there exist two cubic lattice varieties; in one of them, having the lattice parameter 5.581 Å and corresponding to composition CeH_2, hydrogen atoms occupy tetrahedral positions, whereas in the second variety, having the parameter 5.540 Å, hydrogen atoms occupy octahedral sites. The observed reduction of the parameter corresponds to the gradual occupation of the octahedral sites. 5 ref. (M26r; Ce)

177-M. (French.) **Structures and Micrographic Examinations of Special Cast Irons Used in the Construction of Diesel Engines. Pt. 2.** Jean Gonin and Gerard de Smet. *Machine Moderne et Revue Mecanique*, no. 577, Apr. 1957, p. 47-53.

Study of the influence exerted by the introduction of special elements such as nickel and chromium into cast iron; consideration of the structures best suited to produce the qualities demanded of a cast iron used in motor casings. (M27, 1-10, W11, 17-7; CI)

178-M. (French.) **Study Using Microscope and Electronic Diffraction of Tin-Iron Alloy Films on White Iron.** J. J. Trillat and K. Mihama. *Metaux-Corrosion-Industries*, no. 379, Mar. 1957, p. 102-110.

The microscope brings into evidence the increase in dimensions of the grains when the thickness of the alloy film increases. Electronic diffraction demonstrates the existence of a very thin superficial film of complex composition, which covers the alloy $FeSn_2$; in one particular case the presence at the surface of the alloy Fe_3Sn or Fe_5Sn was detected. (M27c, M22h; CI-p, Sn, 14-12)

179-M. (German.) **Osmium-Chromium Alloys.** Ernst Raub. *Zeitschrift für Metallkunde*, v. 48, Feb. 1957, p. 53-56.

Different osmium-chromium alloys were investigated by X-rays, microscope and hardness testing. Osmium dissolves 22.6% Cr. At the composition $OsCr_2$ only sigma phase is found, which is stable at high temperature. At the composition $OsCr_3$ the secondary, beta-W phase which is originated at low temperature occurs. Discussion of structure similarities between the alloys of the platinum metals and the high melting metals of the group 6. 8 ref. (M24b; Os, Cr)

180-M. (German.) **Contribution to the Knowledge About the System Gallium-Germanium.** Ninon de Roche. *Zeitschrift für Metallkunde*, v. 48, Feb. 1957, p. 59-60.

Investigation of the phase diagram gallium-germanium by differential thermal analysis. Calculation of the liquidus curve and of the melting entropy of gallium and germanium from the results. 6 ref. (M24b; Ga, Ge)

181-M. (German.) **Proof of Contaminations and Grain Boundaries by Thermal Etching of Zinc.** Sigmar German. *Zeitschrift für Metallkunde*, v. 48, Feb. 1957, p. 79-80.

Gray residue remaining after thermal etching of zinc is a zinc compound stable at 400° C. and has low vapor pressure. After etching of polycrystalline specimen greater amounts of this residue are found in grain boundaries than in the grains themselves. (M20q, M27f; Zn)

182-M. (German.) **Dilatometer With a Short-Gage Length for Transformation Examination.** Wilhelm Hofmann and Reinhard Müller. *Zeitschrift für Metallkunde*, v. 48, Mar. 1957, p. 104-108.

A self-recording dilatometer with thermocouple measuring tips is used for measurements near the welded seam of steel during the welding process. 3 ref. (M23b, 1-3, K9r)

183-M. (German.) **Three-Dimensional Observations on the Structure of Eutectic Alloys.** Frederick N. Rhines and Walter F. B. Timpe. *Zeitschrift für Metallkunde*, v. 48, Mar. 1957, p. 109-115.

One component was dissolved by selective chemical or electrochemical solution treatment from binary eutectic alloys (aluminum-silicon, silver-silicon, antimony-silicon, sodium-silver, lead-silver), and the remaining component was examined microscopically. 3 ref. (M20q, M27b; Al, Si, Ag, Sb, Na, Pb)

184-M. (German.) **On the Structural Family of Nickel Arsenic.** Paul Esslinger and Konrad Schubert. *Zeitschrift für Metallkunde*, v. 48, Mar. 1957, p. 126-134.

Tabulation and discussion of compounds of the type T50B50 of T (transition) metals and B elements. 19 ref. (M26q; Ni, As)

N Transformations and Resulting Structures

153-N. (French.) **Study by Electron Diffraction of the Formation of Aluminum-Antimony Alloys in Thin Layers.** Pierre Michel. *Comptes Rendus*, v. 243, Dec. 17, 1956, p. 2063-2065.

The structure of thin layers of aluminum-antimony layers, obtained by simultaneous and successive evaporation of the constituent pure metals, was studied by means of electron diffraction. (N16n, M21e; Al, Sb, 14-12)

154-N. (French.) **X-Ray Study of Precipitation Phenomena in the Aluminum-Zinc-Magnesium Alloy Containing 9% Zinc and 1% Manganese (AZ9G1).** René Graf. *Comptes Rendus*, v. 245, Jan. 14, 1957, p. 337-340.

Investigation of the aging process by X-ray diffraction. At ordinary temperatures pre-precipitation phenomena due to spherical-shaped zones are observed. This precipitation leads to the $MgZn_2$ phase. (N7b, M22g; Al, *Mg*, *Zn*)

155-N. (French.) **Faraday's Law Applied to the Anodic Dissolution of Metals.** I. Epelboin and M. Froment. *Métaux-Corrosion-Industries*, v. 32, Feb. 1957, p. 55-72.

Such an application permits the determination of the number of electrons exchanged with the outer circuit and facilitates consideration of the structure of the double electrochemical film. Experimental techniques; anodic dissolution of aluminum, beryllium, magnesium and zinc; use of electrolytic polishing. 49 ref. (N12d, L19, L13p)

156-N. (German.) **Non-Martensitic Structure of an Fe-Mn-C Alloy After Quenching at 1150° C. and Subsequent Deep-Cooling.** A. Masin, D. Tlusta and M. Mrazek. *Acta Technica Academiae Scientiarum Hungaricae*, v. 16, 1957, p. 205-209.

Presents an as yet unknown structural element, different from needle-shaped martensite, established besides normal martensite, in an alloy of 94% iron, 5% manganese and 1% carbon, after quenching at 1150° C. and subsequent deep-cooling. (N8; *Fe*, Mn, C)

157-N. The Effect of Aluminium Nitride Precipitation in Relation to Grain Growth in Steels. A. B. Chatterjea and B. R. Nijhawan. *Indian Institute of Metals, Transactions*, v. 8, 1954-55, p. 225-251.

Existing information on the grain growth in metals and alloys surveyed. In aluminum deoxidized steel, it has been established that there is range of residual aluminum concentration for maximum grain growth inhibition. Hypotheses based on aluminum oxide, residual aluminum, surface adsorption, aluminum sulphide and aluminum nitride as inhibitors of austenitic grain growth have been critically examined. (N3m, N7; ST)

158-N. Studies on Tempering of Carbon Steel Samples by Thermo-Electromotive Forces. J. K. Mukherjee and G. P. Chatterjee. *Indian Institute of Metals, Transactions*, v. 8, 1954-55, p. 217-224.

Changes occurring in the tempering of a quenched steel are the result of the tendency of non-equilibrium strained phases to transform into stable strain-free aggregate of ferrite and carbide. An attempt has been made to study the changes in the thermo-electromotive forces values of quenched samples of carbon steel on tempering at comparatively lower temperatures (50 to 75° C.) for different periods of time. (N8a, P15p; Cn)

159-N. Grain Growth of Titanium Carbide in Nickel. L. P. Skolnick. *Journal of Metals*, v. 9, no. 4, Apr 1957, p. 438-442. (CMA)

The grain growth of TiC in liquid nickel studied by the infiltration method. The grain growth occurred by formation of idiomorphic grains, followed by spheroidization and rapid growth, and, finally, coalescence and closer packing of the grains. Grains appear to grow mainly by dissolution of high energy surfaces, transport of TiC through liquid and isothermal redeposition. (N3; Ni, *Ti*, 1418)

160-N. Computation of M_s for Stainless Steels. F. C. Monkman, Frank B. Cuff, Jr., and N. J. Grant. *Metal Progress*, v. 71, Apr. 1957, p. 94-96.

A new attempt at a linear relationship between M_s temperature and composition in nickel-bearing stainless steels has been made which shows a small improvement over a formerly published equation. Because of the complex interactions of alloying elements, further improvement by first-order equations is not to be expected. (N8p, 1-4; SS)

161-N. The Effect of Cooling Rate on the Nucleation and Growth of Beta-Uranium Hydride in Metallic Uranium. H. R. Gardner and J. W. Riches. General Electric Co. *U.S. Atomic Energy Commission* HW-43428, Oct. 12, 1956, 28 p.

The Jominy end-quenching technique was applied to uranium specimens to study the effect of cooling rate on the nucleation and growth characteristics of beta-uranium hydride in metallic uranium. For cooling rates ranging from 0.002 to 300° C. per sec., it was determined that uranium hydride nucleated primarily at grain boundaries either as discrete particles or in conjunction with carbide-type inclusions. (N2, 3-17; U)

162-N. Grain Size Control in Titanium and the Effect Thereon of Various Addition Agents. Y. C. Liu and H. Margolin. Watertown Arsenal Laboratory, Report 401/105/16, Pt. 1. *U.S. Office of Technical Services*, PB 124519, Nov. 1952, 53 p. (CMA)

Alloying additions do not affect the recrystallization temperature of iodide titanium much. The alpha grain size can be refined by deformation and annealing. Recrystallizing in the alpha-beta field refines the alpha grain size of alloys with 0.1-0.5% addition. Starting structure had little effect on the recrystallized grain size. The activation energy of recrystallization was computed for Ti-0.5C, Ti-0.5V, Ti-0.1Al and Ti-0.5Al. (N5, M27c, 2-10; Ti)

163-N. Study of Freezing Segregation in Titanium Alloy Ingots. J. W. Holladay. Battelle Memorial Institute. Report 62. *U.S. Office of Technical Services*, PB 121606, Jan. 1957, 52 p. (CMA)

Nonuniformities in the mechanical properties and nonhomogeneity in the composition of titanium alloy parts were studied to discover if these faluts were due to freezing segregation. The results of the theoretical analysis are compared with the limited experimental data. (N12, 9-19; Ti)

164-N. (French.) Restoration and Recrystallization of Zirconium and Its Alloys in Relation to Their Cold Working. Jean Hérenguel, Donald Whitwham and Jacques Boghen. *Comptes Rendus*, v. 244, Mar. 4, 1957, p. 1370-1372. (CMA)

Experiments on the restoration and recrystallization of cold worked unalloyed zirconium and an industrial zirconium alloy (1.5% Sn, 0.15% Fe, 0.05% Ni and 0.01% Cr) by heating in air indicated two types of suitable tempering treatments: the usual recrystallization, limiting the temperature to 550-575° C. and the time to 30-15 min., in which the oxide film has a thickness of at most 2 μ; and a more or less complete restoration with gradually improving properties, in which the oxide film is also extremely thin. 3 ref. (N5, J23c; Zr)

165-N. (French.) Precipitation Phase Followed by a Transitory Phase in the Isothermal Aging of a Nickel-Titanium Alloy. Charlotte Bueckle and Jack Manenc. *Comptes Rendus*, v. 244, Mar. 18, 1957, p. 1643-1646. (CMA)

Three structural phases were confirmed by X-ray and micrographic observations of a nickel alloy with 9.26% titanium after isothermal aging subsequent to tempering: a precipitation phase, an unstable gamma prime-phase, and an equilibrium eta-phase. The occurrence of the three phases is comparable to that in aluminum-base alloys, although they occur at a much lower aging temperature (600° C.). 5 ref. (N7c; Ni, *Ti*)

166-N. (German.) On Hot Working of Aluminium. J. Schey. *Acta Technica Academiae Scientiarum Hungaricae*, v. 16, 1957, p. 131-152.

To clarify phenomena taking place in the hot working of aluminum, 99.5% aluminum test specimens, mostly cast, were upset, extruded and rolled at temperatures of 20-650° C. Specimens upset and rolled up to 70% reduction and those extruded at 94% reduction in area showed no recrystallization during hot working. In hot worked specimens recrystallization took place during subsequent heating. (N5, F23, 1-16; Al)

167-N. (Russian.) Recrystallization Diagram of Iodide Zirconium. E. M. Savitskii and V. F. Terekhova. *Akademiya Nauk S.S.S.R. Doklady*, v. 112, Jan. 11, 1957, p. 276-278. (CMA)

Recrystallization in cold worked and annealed iodide zirconium was investigated, and the results are presented in a three-dimensional diagram giving the average size of recrystallized grains as a function of both the degree of deformation (2.5-90% compression on rolling) and the temperature of annealing following rolling (500-1200° C.). The main phenomenon is the great increase in grain size at annealing temperatures corresponding to the alpha-beta transformation of zirconium. It is recommended that cold worked zirconium be annealed at 700-750° C., since at these temperatures the grain size increase is small and the recrystallization reconstitutes completely the pre-deformation structure. Moreover, articles made of zirconium do not oxidize appreciably at these temperatures, even if the annealing is done in air. 3 ref. (N5, N3; Zr)

168-N. (Russian.) Dilatometric Investigation of the Behavior of Zirconium Dioxide and Its Solid Solutions With Calcium and Magnesium. E. K. Keler and A. B. Andreeva. *Ogneupory*, v. 22, no. 2, 1957, p. 65-71. (CMA)

Polymorphic transformations of zirconium dioxide limit its possibilities as a highly refractory material. In a series of dilatometric observations, the authors studied these transformations and the stabilizing influence of oxide of calcium and magnesium. In zirconium dioxide calcined at 1700° C. the transformation begins at about 1000° C. (both in heating and cooling). Quenching after calcination partially stabilizes the tetragonal modification. Stabilized solid solutions 90 mol % ZrO_2 + 10 mol % GaO (or MgO) are destabilized through decomposition into individual oxide phases by heating at 1200-1300° C.; the polymorphic transformation is shifted toward lower temperatures; volume change rate and porosity are increased, while mechanical strength decreases. Excess of stabilizer (e.g., 50% MgO) does not prevent the destabilizing decomposition on heating. 12 ref. (N6; Zr, Ca, Mg)

169-N. The Beta-Alpha Phase Change in Pure Uranium. B. R. Butcher. *Journal of Nuclear Energy*, v. 4, Mar. 1957, p. 273-278.

A review of the literature establishes that there is some controversy over the nature of the beta-alpha phase change in pure uranium. Crystallographic and metallographic experiments undertaken to clarify the position. 17 ref. (N6p; U-a)

170-N. Growth of Mercury Crystals From the Vapor. Gerald W. Sears. *New York Academy of Sciences, Annals*, v. 65, Apr. 11, 1957, p. 388-416.

The growth behavior of mercury "whiskers" and platelets from the vapor phase and explanation of their growth behavior. Growth kinetics for both whiskers and platelets lead to the conclusion that these crystals are nearly perfect. 37 ref. (N3r, N15g; Hg)

171-N. Diffusion in Metals. B. D. Cullity. *Scientific American*, v. 196, May 1957, p. 103-110.

Simple illustration of diffusion mechanism and theory. (N1c)

172-N. Investigation of Diffusion of Boron and Carbon Into Some Metals of the Transition Groups. G. V. Samsonov and V. P. Latysheva. *Henry Brutcher Translation* no. 3902, 11 p. (From *Fizika Metallov I Metallovedenie*, v. 2, no. 2, 1956, p. 309-312.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 370-N, 1956. (N1, B, C)

173-N. (English.) On the Period of Out-of-Step of Ordered Alloys With Anti-Phase Domain Structure. Kunio Fujiwara. *Physical Society of Japan, Journal*, v. 12, Jan. 1957, p. 7-13.

The out-of-step period of ordered alloys with anti-phase domain structure, measured in atomic distance, is generally not an integer. This fractional property of the period has been examined theoretically. Results of numerical calculations in some models of arrangement have been suggested; however, complete regularity in arrangement is not always necessary, uniformity being essential only for the interpretation of the diffraction patterns. (N10, M27g)

174-N. (German.) Stress-Relief and Recrystallization of Aluminum (New Investigations) Pt. 1. D. Altenpohl. *Aluminium*, v. 33, Apr. 1957, p. 226-233.

Some typical examples of stress-relief and recrystallization in cold and hot worked aluminum semi-finished products; relationship between heterogeneous structures and recrystallization. The processes which occur during the heating of a cold worked metal are discussed. (N5, J1a; Al)

175-N. (German.) Investigations of the Isothermal Time-Temperature Conver-

sion Diagrams and the Quenching Hardenability of Steels. Erich Greulich. *Archiv für das Eisenhüttenwesen*, v. 28, Feb. 1957, p. 91-100.

Plotting of isothermal time-temperature conversion diagrams of six steels with 0.16 to 0.72% C; 0.2 to 1.2% Si; 0.6 to 1.4% Mn; 0 to 1.6% Cr; 0 to 0.36% Mo; 0 to 1.5% Ni and 0 to 0.27% V. Natural logarithms of the shortest half-life period as hardenability value. Time-temperature conversion diagrams of previously investigated steels. 8 ref. (N8g, J5, AY)

176-N. (German.) **Investigation of the Isothermal Transformation of Copper-Chromium and Nickel-Chromium Cast Iron With 0.5% of Molybdenum.** Albert De Sy and J. Van Beghem. *Giesserei*, v. 44, no. 8, Apr. 11, 1957, p. 189-199.

Composition of the cast irons examined; determination of the transformation curves; results and their interpretation; examination of the effect of the alloy additions. (N8g; CI-q, *Cu, Cr, Ni, Mo*)

177-N. (German.) **Influence of the Admixture of Antimony on Aluminum Alloys.** W. Thury. *Metall*, v. 11, Mar. 1957, p. 190-192.

Precipitation of magnesium from aluminum-magnesium alloys in form of Mg_3Sb_2. Possibility of removal of magnesium from remelted scrap. 8 ref. (N7, 1-10; Al, *Mg, Sb*)

178-N. (German.) **Significance of Carbide Dissolution on Austenitizing and Its Effect on Transformation of Toolsteels.** Adolf Rose and Leo Rademacher. *Stahl und Eisen*, v. 77, Apr. 4, 1957, p. 409-421.

Austenitizing temperature and time; correlation between austenitizing and nucleation; effect on the transformation of steels; TTT-diagrams for two austenitizing temperatures of hypo-eutectoid, eutectoid and hypereutectoid toolsteels; hardenability and tempering behavior of these steels. (N8, J22; TS)

179-N. (German.) **Electron Microscopic Observations of the Allotropic Transition of Cobalt.** Otto Buhl and Claus Schüler. *Zeitschrift für Metallkunde*, v. 48, Mar. 1957, p. 116-118.

The beta-alpha phase-transition of cobalt is investigated in a pulse-field driven field electron microscope. 13 ref. (N6p, M21e; Co)

180-N. (Russian.) **Titanium, Its Alloys and Fields of Application.** N. T. Gudtsov and L. D. Mashtakova. *Akademiya Nauk S.S.S.R., Vestnik*, v. 27, Feb. 1957, p. 59-68. (CMA)

In a general description of properties of titanium, the problem of the thermal treatment of the metal and its alloys is discussed at some length. While some investigators recognize a general analogy between the thermal behavior of titanium systems and steels, other underline the differences and thus question the possibility of a strengthening quenching in the case of titanium alloys. The very rapid growth of crystal grains at high-temperatures is prevented by resorting to a preliminary deformation (e.g., rolling) which may be either hot (650-880° C.) or cold. High strength combined with a certain plasticity is obtained by rolling in the alpha + beta, quenching and annealing at 450-550° C. for a short time. The appearance of the brittle omega-phase at temperatures below the beta transformation and ways of avoiding its formation are also discussed. (N general; Ti)

Physical Properties

160-P. Reproducing the Properties of Alnico Permanent Magnet Alloys With Elongated Single-Domain Cobalt-Iron Particles. F. E. Luborsky, L. I. Mendelsohn and T. O. Paine. *Journal of Applied Physics*, v. 28, Mar. 1957, p. 344-351.

Single-domain particles of 40-60 cobalt-iron alloy have been prepared with a median diameter of 200 angstrom units, a median elongation of 5.4:1, and intrinsic coercive force of 1950 oersteds. By compacting these particles to various packing densities and degrees of alignment, shape anisotropy fine-particle magnets have been made with magnetic properties duplicating those of each of the Alnico permanent magnet alloys, including maximum energy product values above five million gauss-oersteds. It is concluded that the Alnico alloys and the fine-particle magnets derive their properties from very similar, but not identical, shape anisotropy effects. 17 ref. (P16; Co, Fe, SGA-n)

161-P. Thermal Expansion of Some Nickel Alloys. Peter Hidnert. *Journal of Research of the National Bureau of Standards*, v. 58, Feb. 1957, p. 89-92.

Data on the linear thermal expansion of some nickel alloys (manganese nickel, Hoskins Alloy 667) Inconel, Evanohm, Monel metal, M-M-M alloy, (Illumalloy and Waspalloy) for various temperature ranges between 20 and 1000° C. are given. The coefficients of expansion of the alloys are tabulated. The effects of additions of copper, cobalt and iron to nickel-chromium alloys (0 to 24% Cr) are indicated. 8 ref. (P11g; Ni, 1-10)

162-P. Isotopic Exchange and Evolution of Metal Surfaces in Electrolytic Solutions. U. Camerini, J. Danon and M. Malagolowkin. *Notas de Fisica*, v. 3, no. 8, 12 p.

Investigation of tracer decay by alpha-particle emission; loss of energy detected by measuring the range of the alpha-particles in nuclear emulsions. 17 ref. (P18h, 1-4)

163-P. Influence of Lattice Defects on the Electrical Properties of Cold Worked Metals. H. G. Van Bueren. *Philips Research Reports*, v. 12, Feb. 1957, p. 1-45.

Change of electrical resistivity and of magnetoresistivity, caused by plastic deformation, of the monovalent noble metals from both a theoretical and an experimental point of view. (P15, 3-18, M26s)

164-P. Properties of Gold-Doped Silicon. C. B. Collins, R. O. Carlson and C. J. Gallagher. *Physical Review*, v. 105, Feb. 15, 1957, p. 1168-1173.

Measurement of the temperature dependence of resistivity and Hall coefficient in gold-doped silicon show an acceptor level at 0.54 electron volt from the conduction band and a donor level at 0.35 electron volt from the valence band. (P15g; Si, *Au*)

165-P. Atomic Heats of Normal and Superconducting Thallium. J. W. Snider and J. Nicol. *Physical Review*, v. 105, Feb. 15, 1957, p. 1242-1246.

The atomic heats of thallium have been measured in the liquid helium temperature range. In the normal state, the atomic heat varies with temperature. Equations given for total atomic heat and superconducting electronic specific heat. (P12, P15; Tl)

166-P. Heat Transfer and Thermodynamic Properties of Molten Alkali Metals. I. I. Norikov, A. N. Solovyev, E. M. Khapak Pasheva, V. A. Gruzder, A. I. Pridanter and M. Ya. Vasonina. *Soviet Journal of Atomic Energy*, no. 4, 1956, p. 545-560. (Translated by Consultants Bureau, Inc., 227 W. 17th St., New York 11, N. Y.

An investigation of heat transfer to molten sodium during turbulent flow in a round copper or nickel tube. An interpolation formula was obtained. Results are given for measurements of these physical parameters for molten alkali metals in a broad interval temperature. 18 ref. (P11k, P12; Na, EG-e)

167-P. (French.) **Microscopic Study by Photo-Emission of Metals Submitted to a Mechanical Stress.** Robert Goutte, Clement Guillaud and Robert Arnal. *Comptes Rendus*, v. 243, Dec. 17, 1956, p. 2026-2028.

Measures of photo-electric emission have been effected on metals subjected to stress and have called into evidence an increase in the photo-electric emission on the application of a mechanical stress to the sample; this increase seems reversible if the stress does not exceed the limit of the elasticity of the metal and irreversible in the case of a plastic deformation. 2 ref. (P17d, 3-18)

168-P. (French.) **Properties of Gallium in Thin Layers.** Jean Tortosa. *Comptes Rendus*, v. 243, Dec. 17, 1957, p. 2031-2034.

Study of certain optical and electrical properties of thin films of gallium. 4 ref. (P15, P17; Ga, 14-12)

169-P. (French.) **Influence of the Curie Point on the Oxidation of Magnetite, Fe_3O_4, Iron, Nickel and Certain Iron Alloys.** Laurent Seigneurin and Hubert Forestier. *Comptes Rendus*, v. 243, Dec. 17, 1956, p. 2052-2054.

Ferromagnetic bodies present an anomaly of chemical reactivity at the Curie point. Studies the phenomena of oxidation in the case of iron, nickel, magnetite and certain iron alloys whose Curie point differs from that of pure iron. 4 ref. (P16d, R1h; Fe, Ni)

170-P. (French.) **Study of Hydrogenized Palladium-Nickel and Palladium-Cobalt Alloys.** Joseph Cohen and Jules Wucher. *Comptes Rendus*, v. 244, Jan. 2, 1957, p. 49-52.

Palladium-nickel and palladium-cobalt alloys are ferromagnetic but by saturating these alloys with hydrogen the magnetic moment of palladium disappears. This treatment does not, however, change the ferromagnetic Curie point of the alloy. 7 ref. (P16d; Pd, *Ni, Co, H*)

171-P. (French.) **Note on the Changes in the Electrical Conductivity of Metals at the Time of Melting.** Genevieve Darmois. *Comptes Rendus*, v. 244, Jan. 7, 1957, p. 174-176.

Electronic theory of the conductivity of metals; experimental data and analysis. 3 ref. (P15g)

172-P. (French.) **Surface Tension of Iron, Cobalt and Nickel at 1500° C.** Paul Kozakevitch and Georges Urbain. *Comptes Rendus*, v. 245, Jan. 14, 1957, p. 335-337.

Measurement of the surface tension of iron, cobalt and liquid nick-

el by a method utilizing a globule placed on a refractory support. 7 ref. (P13h, 1-4; Fe, Co, Ni)

173-P. (German.) **The Effect of High-Energy Radiation on Raw Materials.** W. Hanle. *Metall,* v. 11, Feb. 1957, p. 91-99.

Importance of knowledge about interaction of matter with high-energy radiation for nuclear reactor technology; application of radiation-proof materials; very high doses necessary to affect metals. In plastics interesting changes occur with only small doses of radiation. 54 ref. (P18, W11, 17-7, 2-17)

174-P. Dimensional Changes in Nickel Zinc Ferrite in the Neighborhood of the Curie Temperature. R. C. Deshpande. *Indian Institute of Metals, Transactions,* v. 8, 1954-55, p. 253-259.

Dimensional behavior of nickel zinc ferrite has been followed by means of back reflection powder camera in which a suitable furnace is incorporated to heat the specimen. The Curie temperatures have been found as 78 and 95° C. from graphs of initial permeability vs. temperature. X-ray patterns show the structure to be a single-phase spine. 6 ref. (P10d, P16d; Fe, Ni, Zn)

175-P. An Investigation of the Eddy-Current Anomaly in a Low-Silicon Sheet Steel. H. Aspden. *Institution of Electrical Engineers, Proceedings,* Pt. C, Mar. 1957, p. 2-7.

The eddy-current anomaly effects in an 0.019-in. thick low-silicon sheet steel are investigated and analyzed on the basis of the magnetic inhomogeneity arising from ferromagnetic domain structure. The results obtained are interpreted in terms of a hypothetical domain configuration, and it is concluded that the magnetic inhomogeneity arising from ferromagnetic domain structure does account for the eddy-current anomaly, distortion and time-lag effects. (P16c; AY, *Si,* 4-3)

176-P. High-Temperature Properties of Tungsten Which Influence Filament Temperatures, Lives and Thermionic-Emission Densities. R. N. Bloomer. *Institute of Electrical Engineers, Proceedings,* Pt. B, v. 104, Mar. 1957, p. 153-157.

Filament lives have been calculated and measured for a variety of electrical supply conditions in a range of high temperatures. The fractional thinning at burn-out can be found from a measurement of the ratio of lives under different electrical supply conditions. 17 ref. (P15k, S21, 2-12; W, SGA-r)

177-P. A Direct Measurement of the Uranium Metal Temperature Coefficient of Reactivity. R. M. Pearce and D. H. Walker. *Nuclear Science and Engineering,* v. 2, Feb. 1957, p. 24-32.

A uranium sample was oscillated in the reactor and the resulting modulation of reactor power was measured as a function of the sample temperature. The temperature coefficient of uniformly heated uranium rods, 3.25 cm. in diameter, immersed in a constant-temperature moderator (moderator-to-uranium volume ratio 22) is deduced from this experiment. (P12b, 1-4; U)

178-P. Mechanism of Dimensional Instability of Uranium. L. L. Seigle and A. J. Opinsky. *Nuclear Science and Engineering,* v. 2, Feb. 1957, p. 38-48.

An explanation of the dimensional instability of alpha uranium under irradiation is advanced, based upon the anisotropic diffusion of lattice imperfections to grain boundaries and free surfaces. An approximate solution of the diffusion equations for an ellipsoidal grain is obtained, which predicts growth rate as a function of pile flux, temperature and grain size. 22 ref. (P10d, N1b, 2-17; U)

179-P. Research on Properties of Rare Metals. Final Report and Supplements. J. E. Goldman, Simon Foner and George L. Guthrie. Carnegie Institute of Technology. *U.S. Atomic Energy Commission,* NYO-7257, Aug. 31, 1956, 36 p.

The Hall effect in titanium, vanadium, chromium and manganese has been measured at room temperature with fields up to 30 kilo-oersteds. The Hall constant was positve for all of these elements. The results for these transition elements indicate that electrical conduction is predominantly due to hole conduction. (P15g; Ti, V, Cr, Mn)

180-P. Electric, Thermoelectric, Hardness, and Corrosion Properties of Vanadium-Base Alloys. H. J. Cleary. *U.S. Atomic Energy Commission,* NMI-1161, Sept. 5, 1956, 34 p. (CMA)

Various properties of the alloys with 1% Pd, 0.6% Zr, 1% Ti, 0.9% Fe, 0.75% Mn, 1% Cr, 0.8% Cu, 0.8% Ni, 0.9% Sb, 1% Sn, 1.1% Al, 3% Al, 17.3% Al and 25% Al were measured. (P15, Q29n, R general; V)

181-P. Basic Chemistry of High-Temperature Inorganic Systems. Semi-Annual Progress Report. Jan-June 1956. S. J. Yosium and T. A. Milne, North American Aviation, Inc. *U.S. Atomic Energy Commission,* NAA-SR-1797, Mar. 1, 1957, 23 p.

Experiments dealing with the vapor pressure of thorium and thorium tetrafluoride are described. (P12c; Th)

182-P. The Hall Effect in Zirconium and Hafnium. S. Foner. *U.S. Atomic Energy Commission,* NYO-7257, Aug. 31, 1957, p. 23-30. (CMA)

Measurements at 25° C. of the Hall effect in zirconium and hafnium showed Hall effect coefficients of $+12.6 \times 10^{-13}$ and -0.16×10^{-13} v-cm./amp.-gauss, respectively. The contribution of hole conduction to the electrical conductivity appears to be appreciable. (P15g; Zr, Hf)

183-P. Development of Calorimetric Techniques Leading to Measurements on Zirconium. G. L. Guthrie. *U.S. Atomic Energy Commission,* NYO-7257, Aug. 31, 1957, p. 31-36. (CMA)

Development of method and equipment. Calorimetric experiments were conducted with zirconium, but no results are reported. (P12, 1-3; Zr)

184-P. Survey of Physical-Property Data for Titanium and Titanium Alloys. H. W. Deem and C. F. Lucks. Battelle Memorial Institute. *U.S. Office of Technical Services,* Report 39, PB121613, Mar. 1956, 37 p. (CMA)

Literature survey conducted on physical property data for titanium and its alloys. Eighteen properties are covered. (P general; Ti)

185-P. (French.) **On the Measurement of the Coefficient of Thermal Convection of Metallic Wires of Different Sizes.** Israel Epelboin and André Vapaille. *Comptes Rendus,* v. 245, Jan. 14, 1957, p. 314-316.

The determination of the heating theta, assuming the resistance, R, is not to be established by means of the analytic relations recommended in the literature but rather by the aid of an R (theta) curve calculated experimentally. 11 ref. (P11j; 4-11)

186-P. (German.) **The Effect of Small Quantities of Alloying Elements and Impurities on Some Physical Properties of Aluminium.** A. Domony. *Acta Technica Academiae Scientiarum Hungaricae,* v. 16, 1957, p. 153-161.

The electrical conductivity of aluminum depends mainly on the quality of the dissolved elements in the matrix, such as silicon, titanium and vanadium. Tensile strength also depends on the quantity of the impurities present. Distribution of the alloying elements within the metal is also significant. (P15g, Q27a, 2-10, 3-19; Al)

187-P. (Japanese.) **Thermodynamic Investigation of Nonmetallic Inclusions in Steel —Pt. 11. Behavior of Titanium, Zirconium and Vanadium Nitrides and Carbides and Their Effect on Austenitic Grain Size of Steel.** H. Sawamura and T. Mori. *Iron and Steel Institute of Japan, Journal,* v. 43, Jan. 1957, p. 31-38. (CMA)

The free energy equations of the formation in steel of the nitrides and carbides of titanium, zirconium, and vanadium are derived and are used in calculating equilibrium relations of these compounds. TiC, TiN, ZrC and ZrN are effective grain growth inhibitors, especially when precipitated in austenite. V_4C_3 and vanadium nitride may be effective inhibitors. "VC" does not precipitate in steel. (P12a; ST, *Ti, Zr, V,* 9-19)

188-P. Papers of the International Conference on Electron Transport in Metals, Ottawa, Sept., 1956. *Canadian Journal of Physics,* v. 34, no. 12A (Suppl.), Dec. 1956, p. 1171-1423.

Longer papers abstracted separately. (P15)

189-P. On Some Electrical and Magnetic Properties of Metallic Solid Solutions. J. Friedel. *Canadian Journal of Physics,* v. 34, no. 12A (Suppl.), Dec. 1956, p. 1190-1211.

The resistivity, thermo-electric power and magnetic susceptibility of solid solutions at room temperature reviewed. The special properties of transitional impurities are related to the emptying of the *d* shells. 61 ref. (P15, P16, 2-19; 14-17)

190-P. Remarks on the Anomalous Behavior of Alloys Containing Traces of Manganese or Similar Elements. C. J. Gorter, G. J. Van den Berg and J. De Nobel. *Canadian Journal of Physics,* v. 34, no. 12A (Suppl.), Dec. 1956, p. 1281-1284.

Review dealing with electrical conductivity, magnetoresistance, susceptibility, magnetic resonances, thermo-electricity, specific heat, thermal conductivity and Hall effect. 10 ref. (P15, P16, 2-10; *Mn*)

191-P. Nuclear Magnetic Resonance and Electronic Structure of Conductors. V. Bloembergen. *Canadian Journal of Physics,* v. 34, no. 12A (Suppl.), Dec. 1956, p. 1299-1314.

Isotropic and anisotropic metallic shift, the relaxation time, isotropic and anisotropic spin exchange coupling and quadruple interactions discussed. Recent results for semiconductors and superconductors included. 34 ref. (P16f, P15)

192-P. On the Transition to Metallic Conduction in Semiconductors.

N. F. Mott. *Canadian Journal of Physics*, v. 34, no. 12A (Suppl.), Dec. 1956, p. 1356-1368.

Conductivity to be expected from a crystalline array of atoms when the interatomic distance *a* is varied. Applications are made to impurity-bond conduction in semiconduction, the impurity center being treated by the usual model as expanded atoms in a uniform dielectric. 24 ref. (P15g)

193-P. Chemical Bond in Semiconductors. The Group V B to VII B Elements and Compounds Formed Between Them. E. Mooser and W. B. Pearson. *Canadian Journal of Physics*, v. 34, no. 12A (Suppl.), Dec. 1956, p. 1369-1376.

Developments which led to an understanding of the important role played by chemical bonding in semiconductors. Electrical and optical properties discussed. 35 ref. (P15g, P17)

194-P. Specific Heats of Some Metallic Elements. Pt. 3. Characteristic Frequencies. C. V. Raman. *Indian Academy of Sciences, Proceedings*, Section A, v. 45, Feb. 1957, p. 59-64.

The experimental data for the specific heat at constant volume of aluminum, copper, silver and lead were analyzed. The method of analysis was a determination, with the aid of a table of Einstein's specific heat function, of the frequency of atomic vibration which, if assumed to be common to all the atomic oscillators, would give for the specific heat of the solid its observed value at any given temperature. (P12r; Al, Cu, Ag, Pb)

195-P. Magnetostriction and Magnetic Anisotropy of MnBi. H. J. Williams, R. C. Sherwood and O. L. Boothby. *Journal of Applied Physics*, v. 28, Apr. 1957, p. 445-447.

The magnetostriction of oriented polycrystalline manganese-bismuthide was found to be higher than any published value for a metal. A value of -250×10^{-6} was measured parallel to a field of 22,000 oersteds oriented perpendicular to the c axis of the aligned hexagonal crystallites. This field magnetized the specimen to only slightly more than half of saturation. 8 ref. (P16b; Mn, Bi)

196-P. Magnetic Viscosity in 4-79 Molybdenum Permalloy. Oscar J. Van Sant. *Journal of Applied Physics*, v. 28, Apr. 1957, p. 486-494.

The dynamic behavior of 4-79 molybdenum Permalloy operating in a reversible region of its hysteresis loop is analyzed theoretically and experimentally. A useful expression is presented which relates magnetic flux, magnetic intensity, time and magnetic viscosity. (P16; Ni, Mo)

197-P. Electrolytic Hydrogen Evolution Kinetics and Its Relation to the Electronic and Adsorptive Properties of the Metal. B. E. Conway and J. O'M. Bockris. *Journal of Chemical Physics*, v. 26, Mar. 1957, p. 532-541.

A significant correlation between the logarithm of the exchange current density of electrolytic hydrogen evolution reaction and the electronic work function is found for one group of metals. (P15; *H*)

198-P. Heat-Transfer and High-Temperature Properties of Liquid Alkali Metals. I. I. Novikov, A. N. Soloviev, E. M. Khabakhnasheva, V. A. Gruzdev, A. I. Pridantzev and M. Ya. Vasenina. *Journal of Nuclear Energy*, v. 4, Mar. 1957, p. 387-408.

The thermal resistances at the interfaces between liquid sodium and solid copper, nickel and stainless steel were investigated. Methods of measurement of the viscosity, thermal diffusivity and the density of liquid metals. Data on these properties of the liquid alkali metals (sodium, potassium, lithium, sodium-potassium-K eutectic alloy) are given throughout a wide temperature range. 18 ref. (P11k, P10a, P10f, 1-11; EG-e, 14-10)

199-P. Resistance Minimum of Magnesium: Electrical Resistivity Below 1° K. R. A. Hein and R. L. Falge. *Physical Review*, v. 105, Mar. 1, 1957, p. 1433-1434.

Measurements of the electrical resistivity of the two magnesium specimens described by Spohr and Webber have been extended to temperatures below 1° K. At the lowest temperature at which data were obtained (0.22° K.), the electrical resistivities of both specimens were continuing to increase. (P15g, 1-13; Mg)

200-P. Resistance Minimum of Magnesium: Heat Capacity Between 3 and 13° K. J. K. Logan, J. R. Clement and H. R. Jeffers. *Physical Review*, v. 105, Mar. 1, 1957, p. 1435-1437.

Heat capacities were measured for two samples of slightly impure magnesium identical with those whose transport properties have been measured. Although the samples exhibit markedly different transport properties, any systematic difference in their specific heats was found to be less than 5% in the range of measurement. Atomic heat values were in agreement with earlier measurements on pure magnesium in this temperature range. (P12r; Mg)

201-P. Resistance Minimum in Magnesium: Magnetoresistance. R. T. Webber. *Physical Review*, v. 105, Mar. 1, 1957, p. 1437-1439.

The magnetoresistance of two specimens of magnesium has been measured at liquid helium temperatures in transverse magnetic fields up to 25 kilogauss. One specimen, containing 0.013% iron as the predominant impurity and previously shown to possess a minimum in the electrical resistivity at 4.5° K., demonstrated a magnetoresistance which followed Kohler's rule quite exactly. The second specimen, containing 0.043% manganese and previously shown to have a rather large negative magnetoresistance with temperature at helium temperatures, showed a small departure from Kohler's rule. (P16e, 2-13; Mg)

202-P. Neutron Production by Mu Mesons Stopped in Sodium and Magnesium. D. R. Jones. *Physical Review*, v. 105, Mar. 1, 1957, p. 1591-1598.

Measurements of the production of neutrons by negative Mu mesons which stop and interact in two materials, sodium and magnesium. The data confirm that neutron production in magnesium is less than in lead (multiplicity $1.7 = 0.3$) but show that it is not zero. Neutron production in sodium also is shown to be measurable and probably greater than in magnesium, though less than in lead. (P18h; Mg, Na)

203-P. Energy of Formation of Vacancies in Copper and Gold. P. Jongenburger. *Physical Review*, v. 106, Apr. 1, 1957, p. 66-69.

From the anomalous rise of the thermal expansion near the melting point, a value of about 0.7 electron volt for the energy of formation of vacancies in copper and gold is found. (P11g, M26s; Cu, Au)

204-P. Further Ultrasonic Experiments in Superconducting Polycrystalline Tin. L. Mackinnon. *Physical Review*, v. 106, Apr. 1, 1957, p. 70-72.

The effect of a longitudinal magnetic field on the sound absorption in a polycrystalline tin rod below and just above the superconducting transition has been studied. (P15g, Q21f; Sn)

205-P. The Atomic Heat of Samarium From 2 to 20° K. L. M. Roberts. *Physical Society, Proceedings*, v. 70, no. 448B, Apr. 1, 1957, p. 434-435. (CMA)

The magnetic susceptibility of samarium was measured in the range 2-20° K. in an effort to locate an anomaly in the specific heat. A sharp maximum in the atomic heat occurs at 13.6° K. and a small irregularity at 9.5° K. Entropy calculations of the maximum were made. (P12r, P12s; Sm)

206-P. Heat-Capacity Measurements of Titanium and of a Hydride of Titanium for Temperatures from 4 to 15° K. Including a Detailed Description of a Special Adiabatic Specific Heat Calorimeter. M. H. Aven, R. S. Craig and W. E. Wallace. National Advisory Committee for Aeronautics, Technical Note 3787. *U.S. Office of Technical Services*, PB 124368, Oct. 1956, 30 p. (CMA)

The heat capacity of titanium in the 4-15° K. range was measured and can be represented up to 13° K. by the expression $C = 3.38 \times 10^{-3}T + 2.596 \times 10^{-5}T^3$. The expression $C = 0.024\ T + 10^{-4}T^3$ represents the heat capacity of a sample of hydrided titanium. C is the heat capacity in joules per °K. and T is expressed in °K. The calorimeter used is described. 8 ref. (P12r, 1-3; Ti)

207-P. Volume Change and Gas Evolution on Heating Electrolytic Chromium. K. A. Moon and G. A. Consolazio. Watertown Arsenal. *U.S. Office of Technical Services*, PB 121768, Jan. 1956, 15 p. $0.50.

When electrolytic chromium is heated in vacuum or in an inert atmosphere to a sufficiently high temperature, changes are induced which include a pronounced decrease in hardness, loss of gases and irreversible shrinkage of the specimen. A mass spectrometer and a dilatometer were used to study the interrelationships of these changes. (P10d, Q29n, 1-3; Cr)

208-P. (English.) **On the Hall Effect in Bismuth at Low Temperature.** Hiroshi Hasegawa and S. Nakano. *Physical Society of Japan, Journal*, v. 12, Jan. 1957, p. 104.

Measurements of the Hall voltage in bismuth by J. M. Reynolds reanalyzed. (P15g, 2-13; Bi)

209-P. (German.) **Contribution to the Interpretation of the K-State of Resistance Alloys.** Horst G. Müller and Horst A. Schulze. *Zeitschrift für Metallkunde*, v. 48, Feb. 1957, p. 72-79.

Investigation of homogeneous nickel-iron-chromium alloys with a nickel-chromium ratio 4:1 in the K-state by X-ray and electrical conductivity measurements. Increase of low-temperature resistance with cold work-

ing. Lattice-work contraction during the formation of the K-state. 15 ref. (P15; Ni, Cr, SGA-q)

210-P. (German.) **Activation Energy of the Viscosity of Molten Metals.** Anton Hrbek. *Zeitschrift für Metallkunde,* v. 48, Mar. 1957, p. 134-137.

Equation of activation energy of viscosity of molten metals and alloys is found to be in agreement with experimental results. 28 ref. (P10f, P13a; 14-10)

211-P. (German.) **Determination of Optical Constants of Neodymium in the Visible Spectrum and the Near Infrared.** E. Kerr. *Zeitschrift für Physik,* v. 148, no. 1, 1957, p. 38-52.

The absorption and reflection properties of thin sublimated films of neodymium are integrated in the light of the electron theory of metals. Within the spectral range observed the absorption consists of three overlapping bands whose attribution to theoretical quantum states of the energy bands is impossible without arbitrary assumptions. The dispersion data give a value of 0.1 for the number of free electrons per neodymium atom, a value that agrees with the electroconductivity data. No influence of 4f electrons on the optical properties of neodymium was detected. 17 ref. (P17; Nd)

212-P. (Italian.) **Aspects and Problems of Metal Electrochemistry in Ten Years of Studies and Researches.** R. Piontelli. *Metallurgia Italiana,* v. 49, Feb. 1957, p. 69-88.

General aspects of today's metal electrochemistry, both theoretical and applied. 147 ref. (P15, C23, L17)

213-P. (Japanese.) **On the Magnetic Properties of Nickel Arsenide-Type Crystals.** Tokutaro Hirone and Kengo Adachi. *Physical Society of Japan, Journal,* v. 12, Feb. 1957, p. 156-163.

The formation of the ordered arrangement of the magnetic moments of cations (spin ordering or spin arrangement) in the crystal lattice of the nickel arsenide type is studied theoretically with the molecular field approximation, taking into account interaction between pairs of cations, which form the first, second or third neighbors in the crystal lattice. 11 ref. (P16, M26; Ni)

Mechanical Properties and Tests

424-Q. Non-Propagating Cracks in Vee-Notched Specimens Subject to Fatigue Loading. N. E. Frost. *Aeronautical Quarterly,* v. 8, Feb. 1957, p. 1-20.

Reversed direct stress and rotating bending fatigue tests have been carried out on Vee-notched specimens of aluminum alloy, nickel chromium steel and mild steel. Diagrams are presented showing the relationship between the geometric stress concentration factor and the strength reduction factor. 18 ref. (Q7c, Q7d; Al, Ni, CN, AY, *Cr*)

425-Q. How Does 200 Series Stainless Steel Fit in Shop Production Picture? Richard E. Paret. *Artisan,* Mar. 1957, p. 66-69.

Laboratory and time tests on specialty items and parts show that Types 201 and 202 stainless steel are satisfactory replacements for their higher nickel counterparts in the 300 series and need cause no revision in shop techniques or schedules. (Q general, 17-2; SS)

426-Q. Metallurgy of Ductility; a New Law. J. Ryan. *Australasian Engineer,* no. 44, Jan. 7, 1957, p. 48-52.

Effects of hydrostatic pressures on various flow and the fracture characteristics. Any measure of plasticity is only valid for a stipulated pressure. (Q23p, 3-24)

427-Q. Arrest of Brittle Cracks in Ship Plate. J. Hunter. *Australasian Engineer,* no. 45, Feb. 7, 1957, p. 52-58.

A series of tests indicates the possibility of arresting low-temperature brittle cracks in ship plates by introducing a narrow strip of austenitic stainless steel, or in some applications, by a transverse butt weld of austenitic stainless steel. (Q26s; ST, SS)

428-Q. Effects of Cyclic Stress and Frequency on Deformation Markings in Fatigued Copper. D. S. Kemsley. *Australian Aeronautical Research Laboratories,* Report A.R.L./Met 17, 15 p.

Fractured rotating-cantilever specimens tested at stresses ranging from 10,000 to 25,000 psi. and frequencies of 21 and 6000 cycles per min. were sectioned and examined after polishing and etching by optical electron microscopy. An explanation of the main observation is given in terms of interaction between dislocations. 15 ref. (Q7c, M26b, M21e; Cu)

429-Q. Factors Affecting the Mechanical Properties of Pearlitic Nodular Irons. G. N. J. Gilbert. *British Cast Iron Research Association Journal,* v. 6, Feb. 1957, p. 484-497.

Test relationship of chemical composition and microstructure to ductile to brittle transition temperature and the relationship of transition temperature to tensile strength and elongation of pearlitic nodular iron; discusses decrease of transition temperature upon normalizing and relation to strength and elongation; influence of trace elements on strength of basically similar pearlitic irons. (Q23r, 2-10, 3-21; CI-r)

430-Q. Tensile and Fatigue Tests on Normalized Pearlitic Nodular Irons. G. N. J. Gilbert and K. B. Palmer. *British Cast Iron Research Association Journal,* v. 6, Feb. 1957, p. 498-504.

Compares microstructure, tensile strength, elongation, proof stress, hardness and fatigue properties of as-cast and normalized pearlitic nodular irons with silicon contents varying between 1.63 and 2.56%; influence on properties of normalizing temperature and rate of air cooling. (Q general, 2-14; CI-r)

431-Q. Fatigue of Cast Iron. H. Morrogh. *Foundry Trade Journal,* v. 102, Feb. 14, 1957, p. 197-202.

Review of the various cast irons available and methods for the preparation of test pieces. Fatigue properties and stress raisers for flake graphite, malleable and nodular-graphite cast irons are considered in addition to the effects of under and over-stressing in fatigue tests. 28 ref. (Q7a; CI)

432-Q. Fatigue of Cast Iron. H. Morrogh. *Foundry Trade Journal,* v. 102, Feb. 21, 1957, p. 239-244.

Concluding section of literature review deals with effect of surface rolling on fatigue properties of nodular and flake-graphite cast irons of ferritic and pearlitic types. Effects of tension and compression stresses, elevated and subzero temperatures, surface finish and heat treatment on fatigue properties. 30 ref. (Q7a, 3-20; CI)

433-Q. Metallurgy of Cutting Tools. Pt. III—Toughness and Wear Resistance. K. G. Lewis. *Iron and Coal Trades Review,* v. 174, Feb. 22, 1957, p. 453-457.

Discussion of the toughness or resistance of the cutting edge to breakage and chipping. Study of resistance of the tool material to wear or abrasion, review of some of the theories put forward to account for crater wear and for the increased tool life achieved by incorporation of such materials as titanium carbide. 86 ref. (Q9n, T6n)

434-Q. Steady State Creep Through Dislocation Climb. J. Weertman. *Journal of Applied Physics,* v. 28, Mar. 1957, p. 362-364.

A dislocation climb creep model which does not require the production of immobile dislocations is considered. Creep rate is expressed as a function of stress and activation energy. 13 ref. (Q3n, M26b)

435-Q. Metallurgy of Cutting Tools. Pt. IV—Some Theories on the Mechanism of Wear. K. G. Lewis. *Iron and Coal Trades Review,* v. 174, Mar. 1, 1957, p. 503-509.

Review of theories dealing with mechanism of crater wear and with effect on tool life of the incorporation of such materials as titanium carbide. (Q9n, T6n)

436-Q. Theoretical Criterion for the Fracture of Metals Under Combined Alternating Stresses. Takeo Yokobori. *Journal of Applied Mechanics,* v. 24, Mar. 1957, p. 77-80.

Criterion is developed on the basis of the present concepts of dislocations. These concepts are modified by taking into account the stress concentration by the inclusion itself against which dislocations pile up. 15 ref. (Q26r)

437-Q. Experimental Investigation of the Deformed Zone Associated With Indentation Hardness Impressions. L. E. Samuels and T. O. Mulhearn. *Journal of the Mechanics and Physics of Solids,* v. 5, Mar. 1957, p. 125-134.

Using a metallographic method and specimens of 70:30 brass, experimental determinations were made of the elastic-plastic and other low-strain boundaries of the deformed zone associated with indentation hardness impressions. 16 ref. (Q29b, Q24, 1-4; Cu-n)

438-Q. Application Factors for Titanium. *Machine Design,* v. 29, no. 6, Mar. 21, 1957, p. 167-170, 172. (CMA)

Advantages of titanium in designs where it is suitable, namely: weight reduction, stiffness-to-weight ratio, fatigue resistance, strength-to-weight ratio, hot tensile properties, cold creep resistance and corrosion resistance. Welding and forming properties are briefly considered. (Q general, T general, 17-1; Ti)

439-Q. Temper Brittleness. *Mechanical World and Engineering Record,* Mar. 1957, p. 135-137.

Significance and character of temper brittleness; influence of alloys; possible remedies; difference from another condition known as blue-brittleness. (Q26s)

440-Q. Titanium Research and Development—Pt. I. N. P. Inglis. *Metal Industry,* v. 90, Mar. 8, 1957, p. 185-188, 194. (CMA)

The properties of ICI-developed alloys discussed. 314A and 318A are alpha-beta type alloys which

can be heat treated to high strengths by quenching from the alpha-beta field. Fatigue tests, still in progress, show that the fatigue strength of titanium alloys approaches that of steel. Notch tests under reversed bending and reversed direct stresses showed notch sensitivity is greater with the latter. 371 (*a*) has the best creep properties. Difficulties in sheet-forming titanium alloys are considered; a "soft" alloy is sought which can be much hardened by heat treatment. U.S. experiences in sheet rolling are cited.
(Q general; Ti)

441-Q. Titanium Research and Development—Pt. II. N. P. Inglis. *Metal Industry*, v. 90, Mar. 15, 1957, p. 205-206. (CMA)

Work at the Fulmer Research Institute on the hydrogen embrittlement of 314A is cited; properties were unaffected up to 330 ppm. and 300° C. It is noted that no structural change has been discovered in hydrogen-embrittled alpha-beta titanium alloy. The alloys 120, 130, 317 and 371 have been satisfactorily joined by several welding methods. Consumable arc welding requires more stringent precautions than does tungsten arc welding. The fabrication of tubing and extrusions is discussed. (Q26s, K1g; Ti, 4-8, 4-10)

442-Q. Nuclear Engineering: a Device for Tensile Tests of Irradiated Metals. R. E. Hueschen and D. C. Kaulitz. *Nucleonics*, v. 15, Mar. 1957, p. 88-92.

An apparatus that permits tensile testing of highly radioactive specimens at temperatures up to 800° C. It contains an optical unit capable of observing specimen strain through shielding windows. This unit can measure elongations up to 50% with a 1-in. long sample. (Q27, 1-3, 2-17)

443-Q. New High Temperature Intermetallic Materials. Pt. 3. William Arbiter. American Electro Metal Corp. (Wright Development Center). *U.S. Office of Technical Services*, PB 121019, Dec. 1954, 98 p. $2.50.

Average properties of a large number of compositions in the chromium-titanium-oxygen-nitrogen systems. In both systems nitrogen additions increased brittleness while increasing high-temperature strength. Silicide compositions tested showed brittle behavior and attempts to modify this by the addition of metallic binders resulted in little, if any, improvement. (Q26s, Q27a, 2-12)

444-Q. Selection of Materials for High-Temperature Applications in Airframes: Supplement. S. A. Gordon and L. R. Jackson. Battelle Memorial Institute (Wright Development Center). *U.S. Office of Technical Services*, PB 121602, Feb. 1956, 30 p.

General information for design of airframes was derived from crippling tests on channel and angle sections on C-110 M titanium alloy at temperatures to 800° F. Results were used to calculate the structural index which was compared with the theoretical structural index through data from the compressive stress-strain curves of the materials involved.
(Q28g, T24a, 17-1, 2-12; SGA-h)

445-Q. Effects of Specimen Preparation on Fatigue. F. H. Vitovec and H. F. Binder. University of Minnesota. (Wright Development Center). *U.S. Office of Technical Services*. PB 121576, Aug. 1956, 53 p. $1.50.

Investigation of the penetration of plastic deformation caused by the notch preparation. Data are reported on the effect of lapping procedure on the Prot failure stress of SAE B1113 steel and SAE 1020 steel.
(Q7, 1-10; CN)

446-Q. Fatigue, Creep, and Rupture Properties of Heat Resistant Materials. F. H. Vitovec and B. J. Lazan. University of Minnesota. (Wright Development Center). *U.S. Office of Technical Services*, PB 121580, Aug. 1956, 213 p.

The heat resistant alloys Stellite 31, S-816, 6.3% Mo Waspalloy, 7% Mo Waspalloy, M-252, Inconel X-550, 16-25-6 Timken, Crucible 422, Lapelloy and Stainless Type 403 were studied at temperatures up to 1650° F. under various combinations of alternating and mean stress. Notched and unnotched specimens were used. (Q7a, Q3m; SGA-h)

447-Q. Investigation of the Compressive, Bearing, and Shear Creep-Rupture Properties of Aircraft Structural Metals and Joints at Elevated Temperatures. F. J. Vawter. Cornell Aeronautical Laboratory, Inc. (Wright Development Center). *U.S. Office of Technical Services, PB* 121656, Sept. 1956, 95 p. $2.50.

High-temperature creep data on aircraft sheet, plate and rivet structural alloys under the influence of shear, bearing and compressive stresses.
(Q3m, Q28g, Q2g, T24; SGB-s)

448-Q. (French.) **Measurement of the Modulus of Rigidity of Sintered Alumina up to 1000° C.** Christiane Susse. *Comptes Rendus*, v. 245, Jan. 14, 1957, p. 302-305.

Sample investigated was of 99.5% pure alumina, the impurities contained being silica, sodium hydroxide and potassium hydroxide, together with traces of vanadium and magnesium. It was sintered at 1900° C. Microscopic observation; modulus of rigidity as a function of temperature; discussion of results.
(Q21, 1-11; Al, 6-22)

449-Q. (French.) **Study of Tungsten Carbide Tool Wear by Means of Radioactive Tracers.** H. Creuzot and P. Leveque. *Revue Générale de Mecanique*, v. 41, Jan. 1957, p. 1-5.

New method for investigating wear of cutting tools renders the tool radioactive and studies the emissivity of the shavings; factors in the choice of tracer elements; activation; methods of testing; calculation of results. Permits comparision of results with the gravimetric method. (To be continued.)
(Q9n, 1-4, 14-13; W, 6-19)

450-Q. (German.) **Permanent Deformation of Helical Springs.** U. Otzen. *Draht*, v. 8, Feb. 1957, p. 49-54.

Influence of tensile strength, yield, strength, elongation, constriction and the twisting factor. Importance for the manufacture of helical springs. (Q23b, Q27a, Q1a, T7c)

451-Q. (German.) **Stress Analysis. Pt. I.** K. Matthaes. *Metall*, v. 11, Feb. 1957, p. 99-104.

Discussion of tensile strength from the mathematical, physical and chemical viewpoints. Description of the elastic properties. 14 ref.
(Q25, Q27a)

452-Q. (German.) **Contribution to the Deformation of Copper-Zinc Alloys, Especially of Beta-Brass.** E. Pelzel. *Metall*, v. 11, Feb. 1957, p. 123-127.

Two components determine the physical properties of binary copper-zinc alloys: (*a*) the alpha-solid solution in the concentration region between pure copper and copper with 40% zinc, and (*b*) the beta-solid solution with a zinc content of 46-50%. Investigation of the correlation between deformation forces, composition and temperature. 4 ref.
(Q24, M27b; Cu-n)

453-Q. (German.) **Work Hardening of Round Steel Wire When Using Different Methods of Shaping. Pt. II. Influence of a Preliminary Deformation by Drawing on the Strength Obtained in Subsequent Flat Rolling.** Winfred Dahl and Werner Lueg. *Stahl und Eisen*, v. 77, Mar. 21, 1957, p. 334-340.

Review of the literature; determination of the tensile strength in flat rolling and pressing of predrawn round wire containing 0.03 and 0.45% C.; comparison with previous results. (Q24; ST, 4-11)

454-Q. (German.) **Effect of Different Conditions of Temper Rolling and Aging on the Yield Point of Deep-Drawing Strip Steels.** Fritz Fisher, Matthias Nacken and Vincenz Seul. *Stahl und Eisen*, v. 77, Mar. 1957, p. 340-346.

Effect of aging under different conditions of temper rolling; interpretation of the test results with the aid of the dislocation theory.
(Q23b, F23r, 2-15; ST, 4-3)

455-Q. (Russian.) **Normal Elasticity Modulus of Zirconium-Columbium Alloys.** Yu. F. Bychkov, A. N. Rozanov and D. M. Skorov. *Atomnaya Energiya*, v. 2, Feb. 1957, p. 152-156. (CMA)

The normal elasticity modulus (Young's modulus) of zirconium-columbium alloys (0-100% Cb) was measured at temperatures up to 950° C. and at room temperature for various thermal treatments. 4 ref. (Q21a, 1-11; Zr, Cb)

456-Q. Hydrogen Contents of Mild and Alloy Steel Weld Deposits With Some Reference to the Effects of Hydrogen Embrittlement in Welded Joints. P. D. Blake. *British Welding Journal*, v. 4, Mar. 1957, p. 146-154.

Records experimentally determined hydrogen contents of variety of weld deposits. Data on effect of drying electrodes immediately before use and the evolution of hydrogen from weld metal at progressively higher temperatures; discusses question of hydrogen embrittlement and puts forward theory of four possible mechanisms which can apply. 25 ref. (Q26s; AY, *H*, 7-1)

457-Q. Tensile Strength of Light Steel. E. W. Williams. *Canadian Mining and Metallurgical Bulletin*, v. 50, Mar. 1957, p. 147-153. (*Transactions*, v. 60, 1957, p. 89-95.)

Experimental study of tensile properties of controlled density steel produced by sintering iron oxide powder in presence of coke. Results of microscopic examination and mechanical testing of test specimens varied in density, carbon content, cooling rate, chromium, manganese, nickel, molybdenum, copper, cobalt or phosphorus content.
(Q27a, 2-10; ST)

458-Q. Suitability of Indian Pig Irons for the Production of Nodular Cast Irons. P. K. Gupte, M. N. Parthasarathi and B. R. Nijhawan. *Indian Institute of Metals, Transactions*, v. 8, 1954-55, p. 129-164.

A series of experiments carried out to determine the maximum percentage of phosphorus permissible without deterioration in the mechanical properties of the nodular iron. The relation between the various mechanical properties, such as tensile strength, ductility, etc., and the microstructure is discussed. The importance of the proper control of composition is brought out. Having determined the maximum phosphorus content, the various methods of reducing the phosphorus content in cast iron are discussed in the light of latest trends in foundry practice.
(Q general, M27, E25q; CI-r)

459-Q. Damping Characteristics and Decay of Vibration Amplitude of Metals and Alloys From Energy Considerations. S. Ghosh, K. C. Som, A. K. Lahiri and G. P. Chatterjee. *Indian Institute of Metals, Transactions,* v. 8, 1954-55, p. 165-185.

A simple instrument has been constructed to measure the specific damping capacities of metals and alloys by the torsional oscillation method. It has been shown that vibration damping capacities of carbon and low-alloy steels reach a maximum and then sharply decrease with increasing performance values —the so-called P-values of steels. Quenched specimens of plain carbon steel show appreciable changes in damping capacity on low-temperature tempering even for short periods of time. (Q8g, 1-3; Cn, AY)

460-Q. Investigation on the Development of Low-Carbon Low-Alloy Case Hardening and High-Strength Steels With Electrolytic Manganese. S. Visvanathan, S. N. Anant Narayan and P. K. Chakravarty. *Indian Institute of Metals, Transactions,* v. 8, 1954-55, p. 187-216.

Possibility of utilizing electrolytic manganese for the production of two categories of low-carbon steel (viz., alloy case hardening steels and weldable high-tensile steels for replacing the commoner commercial grades which employ other alloy additions). For this purpose, a number of steel compositions were chosen and the properties of bars forged from experimental heats compared with those of standard grades.
(Q general, 17-2; AY-n, *Mn,* AD-a)

461-Q. Effect of Ceramic Coatings on Creep of Alloys. J. R. Cuthill, J. C. Richmond and N. J. Tighe. *Industrial Heating,* v. 24, Mar. 1957, p. 582-588.

Ceramic coatings on 80-20 Ni-Cr alloys greatly reduced creep rate and void formation at high temperatures in tests at National Bureau of Standards. (Q3n; Ni, *Cr,* 8-21)

462-Q. High-Strength Zirconium Alloy: Zr-4 Wt-% Sn-1.6 Wt-% Mo. W. Chubb. *Journal of Metals,* v. 9, Apr. 1957, p. 461-468. (CMA)

Zr-4Sn-1.6Mo is heat treatable, readily rolled at 800° C. and has a creep strength at 500° C. which is four times that of zirconium. Cold reduction greater than 20% can be effected in the annealed condition. Tensile strength in the heat treated condition may exceed 140,000 psi. Air quenching hardens the alloy more than water quenching.
(Q27a, Q3m, 1-12, J26; Zr)

463-Q. Effect of Small Amounts of Alloying Elements on the Ductility of Cast Molybdenum. L. E. Olds and G. W. P. Rengstorff. *Journal of Metals,* v. 9, Apr. 1957, p. 468-471. (CMA)

The effect on the ductility of cast molybdenum was studied by adding 0.5-1.0% titanium, 10% thorium, 0.026% aluminum, 0.1% cerium, 0.5% vanadium and under 0.25% zirconium. They were effective in lowering the bend-angle transition temperature in the above order. The thorium addition causes hot shortness above 1500° F.
(Q23p, 2-10; Mo, 5)

464-Q. Hot Work Steels for Aircraft Structures. Edward A. Loria. *Materials and Methods,* v. 45, Mar. 1957, p. 115-119.

Data on short-time elevated-temperature tensile and yield properties, tensile stability at high temperatures and creep properties at elevated temperatures of three hot worked steels. (Q27a, Q3m, 1-12; TS)

465-Q. Steam Piping Materials for High Temperature Service. H. S. Blumberg. *Materials and Methods,* v. 45, Mar. 1957, p. 126-129.

Requirements of steels to be used as steam piping materials at high operating temperatures and pressures including working properties, strength and stability; characteristics of ferritic and austenitic stainless steels currently used and new alloys under development.
(Q23, 1-12; ST, 4-10)

466-Q. Metals for High-Speed Flight. Wolfgang H. Steurer. *Metal Progress,* v. 71, Apr. 1957, p. 66-73.

At very short periods of exposure to high temperatures in terms of minutes or seconds, many metallic materials show properties far superior to those obtained in conventional tests. Consequently, they can often admirably resist the transient heat conditions encountered in guided missiles and high-speed aircraft.
(Q27a, 2-12, 3-17; SGA-h, SGA-b)

467-Q. Embrittlement (?) of Phosphated Steel. Harold P. Weinberg and Thomas J. Capello. *Metal Progress,* v. 71, Apr. 1957, p. 78-81.

Embrittlement of chromium-nickel-molybdenum steel, F.S. 4340, heat treated to high strength, by phosphate coating of either zinc base or manganese base can be prevented by aging 24 hr. at room temperature or by baking 1 hr. at 220° F.
(Q26s, L14b; AY)

468-Q. Improved Ductility in Titanium Welds. M. L. Kohn, G. E. Faulkner and G. W. Bauer. *Metal Progress,* v. 71, Apr. 1957, p. 82-86.

The commercial alpha-beta alloy with 6% Al and 4% V has deficient bend ductility when welded with filler metal of the same composition, but much better when welded with unalloyed titanium as filler metal, especially after a long anneal in the alpha-beta phase region.
(Q5g, K9, 2-10; Ti)

469-Q. Fatigue Properties of Brasses, Bronzes and Bearing Metals. J. W. Cuthbertson. *Metal Treatment and Drop Forging,* v. 24, Mar. 1957, p. 89-92.

Surveys fatigue characteristics of various copper-base and bearing alloys; their applications and the mechanisms by which bearings fail through fatigue. (To be continued.)
(Q7a; Cu, SGA-c)

470-Q. Better Forgings — Proper Testing Is Essential for Improved Products. Ihor E. Suchoversky. *Steel Processing and Conversion,* v. 43, Mar. 1957, p. 127-134.

Since forgings lack the simplicity of products such as sheet and extrusions, the selection of representative mechanical testing locations constitutes a major problem. Discussion of the selection of testing locations in aluminum-alloy forgings and the effect of directionality on mechanical properties.
(Q general, 1-10, 1-4; Al, 4-1)

471-Q. Hidden Troublemakers; Residual Machining Stress. Erik K. Henriksen. *Tool Engineer,* v. 38, Apr. 1957, p. 92-96.

Origin of machining stresses and mechanism of stress formation from single-point tools. Variation of stress with rake angle, depth of cut, tool nose radius and material being cut. Stresses from milling cutters and from grinding. (Q25h, G17)

472-Q. Hot Malleability of Zircaloy-2 and High Zirconium-Uranium Alloys. R. E. Droegkamp. *U.S. Atomic Energy Commission,* WAPD-LSR (FE)-3, Feb. 5, 1955, 19 p. (CMA)

Specimens of zirconium-uranium alloys (50, 60, 70 and 80% zirconium) and Zircaloy-2 were hot compression tested at temperatures between 1000 and 1600° F. The edge-cracking of Zircaloy-2 indicates its poor malleability at certain temperatures, but malleability is good as low as 1500° F. The malleability of zirconium-uranium alloys extended down to 1000° F., where failure was of the shearing type. Data show that greater reductions could be taken, resulting in more uniform flow and a greater yield.
(Q23q, Q28, 1-12; Zr, *U*)

473-Q. Properties of Zirconium and Its Alloys. Pt. I. Properties of Zirconium; Pt. II. Properties of Zircaloy-2; Pt. III. Experimental Alloys. P. J. Pankaskie. *U.S. Atomic Energy Commission,* NAA-SR-MEMO-1269, Mar. 11, 1955, 64 p. (CMA)

The mechanical, creep and fatigue properties of zirconium and Zircaloy-2 and the effect of gases thereon reviewed and discussed. Also covered are their coefficients of thermal expansion, thermodynamic values, and reactivity at high temperatures with the halogens, hydrogen, oxygen, nitrogen, carbon monoxide, carbon dioxide and air. Binary zirconium alloys are classified according to the eutectic, eutectoid and solubility effects. Graphs are presented for tensile and yield strength and elongation vs. addition (aluminum, chromium, copper, iron manganese, molybdenum, nickel, niobium, silicon, tin, tantalum, titanium, tungsten or vanadium). Experimental data for ternary alloys of zirconium compared with data on zirconium and stainless steel.
(Q general, P11g, P12, 1-10; Zr)

474-Q. Stress-Strain Characteristics of Uranium. David A. McCutchan and Glenn Murphy. Iowa State College. *U.S. Atomic Energy Commission,* ISC-700, Dec. 1955, 37 p.

Tests were made in reversed loading and in repeated tensile loading on 13 specimens of rolled alpha-uranium at room temperature. Constant strain rates ranging from 0.0003 in. per in. per min. to 0.0060 in. per in. per min. were employed.
(Q25n, Q27; U)

475-Q. Fretting Wear of Zircaloy-2 Pellets and Consequences Thereof. L. A. Waldman and P. Cohen. *U.S. Atomic Energy Commission,* WAPD-CPM-3, Jan. 9, 1956, 23 p. (CMA)

The fretting rate of Zircaloy-2 pellets in a packed bed was determined

to be 4.1 mg. per sq. dm. and not serious with respect to clad integrity. The treatment of the data is analytical. Activity levels reached in the primary system with the above rate are not significant with respect to the loop compartment.
(Q9q; Zr, 6-17)

476-Q. Uranium Alloys for High-Temperature Application. Henry A. Saller, Ronald F. Dickerson and William E. Murr. Battelle Memorial Institute. *U.S. Atomic Energy Commission,* BMI-1098, June 25, 1956, 45 p.

Deals with some properties of uranium alloys with 3.5, 5, 7, 9 and 12% Mo and with 3, 5, 7, 10, 15 and 20% Zr. Results of a heat treatment study, hot hardness and dilation data, and effects of beta and gamma thermal cycling upon cylinders of both alloy groups are given.
(Q general, 1-12; U, *Mo, Zr*)

477-Q. The Creep of Zircaloy-2 Process Tubes. A. B. Burgess. *U.S. Atomic Energy Commission,* HW-45567, Sept. 17, 1956, 14 p. (CMA)

A consideration of the creep problems and related factors emphasized the determination of tube-wall thickness. Minimum thickness is limited by creep. Further information is desirable and several types of experiments are recommended. 22 ref.
(Q3; Zr, 4-10)

478-Q. The Mechanical Properties of Zirconium and Zircaloy-2. F. R. Shober, et al. *U.S. Atomic Energy Commission,* EMI-1168, Feb. 18, 1957, 48 p. (CMA)

A study of annealing time for zirconium and Zircaloy-2 showed that at 500° C. the softening rate was too fast for utilization of the increased tensile strengths from cold working. Zircaloy-2 decreased in creep-rupture strength in the 150-500° C. range in 1000-hr. tests. Rolled sheet showed no significant directional properties. Hydraulic bursting tests on seamless Zircaloy-2 and on welded zirconium tubing showed the superiority of the former; the latter failed at the longitudinal seam weld. 5 ref.
(Q general, 2-14; Zr)

479-Q. Flow Stress Recovery of Zircaloy-3B. D. E. Johnson. *U.S. Atomic Energy Commission,* HW-44906, 1956, 21 p. (CMA)

A study of changes in the mechanical properties of Zircaloy-3B at moderately high temperatures showed that increases in strength from cold working are soon lost. Partial recrystallization in 40 and 60% cold worked alloy is lost at 400° C. after 25 days and 12½ days, respectively. It is suggested that the creep rate and flow stress recovery of the alloy are intimately related.
(Q general, 3-18; Zr)

480-Q. Evaluation of Compression-Testing Techniques for Determining Elevated-Temperature Properties of Titanium Sheet. W. S. Hyler. Battelle Memorial Institute. *U.S. Office of Technical Services,* Report 43, PB 121615, June 1956, 73 p. (CMA)

Techniques are evaluated for testing titanium sheet for high-temperature compression properties. Recommendations as to equipment and procedure. (Q28, 1-4, 2-12; Ti)

481-Q. Devices for Damping Mechanical Vibrations, a Bibliography. M. Benton. Naval Research Laboratory. *U.S. Office of Technical Services,* PB 121299, Dec. 1956, 101 p. $2.75.

References cover studies of vibration damping by increasing mechanical impedance of the system, by energy dissipation, or by tuned attachments, and of vibration isolation by vibration dampers, connection damping and material damping.
(Q8)

482-Q. Investigation of the Mechanical Properties of Metal-Arc Welded Ti-6%-Al-4% V. D. M. Daley, Jr., and C. E. Hartbower. *Welding Journal,* v. 36, Apr. 1957, p. 185s-191s. (CMA)

Weld deposits of Ti-6Al-4V were prepared by inert-gas-shielded, tungsten-arc welding (Ti-6Al-4V filler) and evaluated for tensile and notch-bar properties. Tensile joint efficiency was about 100% at an ultimate tensile strength of 150,000 psi. and 10 ft-lb. V-notch Charpy impact energy at −40° C. The notch toughness of a weld produced by the inert-gas-shielded consumable-electrode process was studied and found to be greater than in other alpha-beta titanium alloys.
(Q27a, Q6n; Ti, 7-1)

483-Q. Tungsten and the High-Temperature Age. R. H. Thielemann. *Western Machinery and Steel World,* v. 48, Mar. 1957, p. 112-115.

Problems in developing high-temperature alloys. Physical and tensile properties of columbium, molybdenum, tantalum and tungsten and possibilities of use at high temperatures; Stellite 31 modified by addition of tungsten showed double the rupture life at 600° F. and 30 times the rupture life with addition of tungsten plus columbium.
(Q27a, Q3m; Cb, Mo, Ta, W, SGA-h)

484-Q. (German.) **Average Degree of Lengthening in Measuring Rolling Mill Rolls of Irregular Design.** Zymunt Wasatowski. *Neue Hütte,* v. 2, Jan. 1957, p. 24-35.

Theoretical comparison of various formulas proposed for estimating the average degree of lengthening.
(Q24, W23)

485-Q. (Italian.) **Experimental Study of Internal Friction and Elastic Parameters in Ag-Au Alloys.** I. Barducci and L. Verdini. *Nuovo Cimento,* Suppl. to v. 4, Series X, no. 2, 1956, p. 1042-1056.

Silver-gold alloy chosen for study because of its simple phase diagram and complete compatibility of the two metals at all temperatures and in any proportions. Preparation of specimens, measuring methods, results. 13 ref. (Q21, Q22, 1-4; Ag, Au)

486-Q. (Japanese.) **Effect of Mo and V Additions on Si-Cr-W Steels for Shock-Resisting Tools.** S. Koshiba and T. Kuno. *Iron and Steel Institute of Japan, Journal,* v. 43, Feb. 1957, p. 142-145. (CMA)

The transformation point, quenching and tempering hardness, hardenability, microstructures, rate of deformation and mechanical properties at high temperatures were measured. A remarkable improvement in properties is noted when such additions are made.
(Q general, J5, M27, 1-10; TS)

487-Q. Plastic Deformation of Single Crystals. M. S. Paterson. *Australian Institute of Metals, Journal,* v. 1, Oct. 1956, p. 112-124.

Literature review includes discussion of ductility of crystals and nature of slip and twinning. Section on crystallography and geometry of slip. Covers observations on nature of slip bands and deformation bands. Part on slip mechanics discusses sharp yield points, easy glide, effect of surface conditions, time, temperature and the application of dislocation theory to yielding and strain hardening. 115 ref. (Q24; 14-11)

488-Q. Deformation of Polycrystalline Aggregates. M. E. Hargreaves. *Australian Institute of Metals, Journal,* v. 1, Oct. 1956, p. 125-133.

Includes theories that attempt to calculate plastic properties of a polycrystalline aggregate from properties of single crystals. Experimental evidence relevant to these calculations and to the general behavior and interactions between metal grains in the deformation of aggregates. 22 ref. (Q24)

489-Q. Slow Deformation of Metals, Particularly at Elevated Temperatures. R. C. Gifkins. *Australian Institute of Metals, Journal,* v. 1, Oct. 1956, p. 134-147.

Literature review gives empirical and formal expressions for creep curve; examines the functions of coarse slip, cell substructure, fine slip and boundary sliding in relation to theories of creep in pure metals and simple alloys. 76 ref.
(Q3n, Q24)

490-Q. Fatigue. A. K. Head. *Australian Institute of Metals, Journal,* v. 1, Oct. 1956, p. 148-154.

Reviews research on mechanism of fatigue of simple metals such as copper, aluminum; experimental observations and theoretical explanations in bulk deformation, crack formation, and crack growth in metal fatigue. 30 ref. (Q7)

491-Q. Fracture. H. L. Wain. *Australian Institute of Metals, Journal,* v. 1, Oct. 1956, p. 155-169.

Theories on the mechanisms of fracture of metals. Assesses ideas in terms of experimental observations. Among hypotheses described are Orowan's to account for certain macrocharacteristics of fracture, Mott-Stroh's theories of stresses arising from dislocation pile-ups at obstacles, and Cottrell's of the locking of dislocations by specific impurity atoms. 59 ref. (Q26)

492-Q. Tensile Properties of Copper, Nickel and 70% Copper, 30% Nickel and 30% Copper, 70% Nickel Alloys at High Temperatures. William D. Jenkins, Thomas G. Digges and Carl R. Johnson. *Journal of Research of the National Bureau of Standards,* v. 58, Apr. 1957, p. 201-211.

The high-purity component metals and the two alloys were investigated in the initial conditions, as annealed for a uniform grain size, and as cold drawn to 40% reduction in area. The results were affected markedly by variations in the nickel content, temperature and degree of cold working. 13 ref.
(Q27a, 2-12; Cu, Ni)

493-Q. Effect of Ceramic Coatings on Creep of Alloys. J. R. Cuthill, J. C. Richmond and N. J. Tighe. *Metal Products Manufacturing,* v. 14, Apr. 1957, p. 34-35.

Creep curves for two coated and uncoated 80-20 Ni-Cr alloy specimens under stress at an elevated temperature. Results show that the beneficial effect on the creep behavior of both alloys is sufficient to be of importance. (Q3m; Ni, Cr, 8-21)

494-Q. Assessment of the Drawing and Forming Qualities of Sheet Metal by the Swift Cup-Forming Test. Pt.

3. Correlation of the Test With Press Performance. O. H. Kemmis. *Sheet Metal Industries,* v. 34, Apr. 1957, p. 251-255.

Test results are compared to findings from automobile body press shop and press results for wheelbarrow, wash tubs and clutch covers. Correlation indicates possible usefulness of cup-forming tests in assessing materials for deep drawing. (Q23q, G4, 1-4)

495-Q. Hardness Testing of Sheet Metal. *Sheet Metal Industries,* v. 34, Apr. 1957, p. 267-272.

Results of survey of sheet metal industry in Great Britian to determine amount of standardization of hardness testing procedures. Data on diamond pyramid hardness test made by 73 firms on thin copper and hardened steel samples. (Q29c; ST, Cu, 4-3)

496-Q. Mechanical Properties of Steel Sheet Rolled From Continuously Cast Ingots. N. L. Komandin. *Sheet Metal Industries,* v. 34, Apr. 1957, p. 289-290.

Results of tensile, elongation and impact tests taken in logitudinal and transverse directions from conventional and continuously cast steel ingot at the Krasnoye Sormovo plant in the U.S.S.R. (Q27a, Q6n, D9q; ST, 4-3)

497-Q. Survey of the Problems of Delayed Cracking in Formed Titanium Parts. R. I. Jaffee and D. J. Maykuth. Battelle Memorial Institute, Report 7. *U.S. Office of Technical Services,* PB 124562, June 1955. 53 p. (CMA)

Hydrogen embrittlement and high residual stresses due to forming or assembly methods are the main reasons that Ti-8Mn sheet showed delayed cracking in the F-100 aft section. The recent Air Force specification of 150 ppm. of hydrogen is just adequate and may need downward revision. (Q26s, Q25h; Ti, 9-22)

498-Q. Formability Tests on Titanium Alloy Sheet. L. R. Jackson. Battelle Memorial Institute, Report 12, *U.S. Office of Technical Services,* PB 124565, July 1955, 25 p. (CMA)

Procedures for tensile testing and minimum-bend-radius testing of RC-70 sheet. It is recommended that values be obtained for percent reduction in area and that all laboratories use the same method in bend test. (Q23q, 1-4, Q27, Q5; Ti, 4-3)

499-Q. Effect of Cold Reduction on Irreversible and Reversible Temper Brittleness. M. M. Shteinberg, V. D. Sadovskii and A. V. Demakova. *Henry Brutcher Translation* no. 3812, 10 p. (From *Metallovedenie I Obrabotka Metallov,* v. 2, no. 6, 1956, p. 26-35.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 869-Q. 1956. (Q23, Q6, Q29, J29, CN)

500-Q. (French.) **Cast Irons With a High Modulus of Elasticity.** *Journal d'Informations Techniques des Industries de la Fonderie,* no. 84, Feb. 1957, p. 9-11.

General discussion and definition of modulus of elasticity; factors determining this property; steps to be taken to obtain cast iron with a high modulus of elasticity. (Q21a; CI)

501-Q. (French.) **Special Nickel-Chromium Alloys (Nimonics) for Gas Turbine Blades.** W. Betteridge. *Metaux-Corrosion-Industries,* no. 379, Mar. 1957, p. 111-121.

Mechanical properties and testing of Nimonic 80A and Nimonic 90 currently used on a large scale in the manufacture of rotor blades for gas turbines used in aviation; influence of different aging treatments on creep properties. (Q general, Q3m, T7; Ni, Cr)

502-Q. (French.) **Mechanical Properties of Nickel and Nickel Alloy Deposits.** H. C. Castell. *Metaux-Corrosion-Industries,* no. 379, Mar. 1957, p. 122-131.

Effects of the variation of hardness, internal stress, elastic limit and ductility on the behavior of different deposits of nickel; typical mechanical properties of nickel deposits (dull and bright) and of cobalt-nickel, zinc-nickel and phosphorus-nickel; application of such deposits; discussion of processes. 11 ref. (Q general, *Ni,* 8-12)

503-Q. (German.) **Dry Friction of Some Aluminium Alloys and Steels.** F. Bollenrath and H. Grefkes. *Aluminium,* v. 33, Apr. 1957, p. 234-240.

Review of the present state of knowledge of dry friction; determination of coefficients of friction; importance of structure and geometry of the surface layers; cold welding; frictional oxidation. 38 ref. (Q9p; Al, ST)

504-Q. (German.) **Buckling Tests With Aluminium Compression Members.** B. Braathen and B. R. Noton. *Aluminium,* v. 33, Apr. 1957, p. 241-249.

Theoretical ultimate loads were calculated using the tangent-modulus theory, the reduced-modulus theory and extended Southwell method. 12 ref. (Q28, 1-4; Al)

505-Q. (German.) **S.A.P., the Sintered Aluminum Material of High Hot Strength.** R. Irmann. *Aluminium,* v. 33, Apr. 1957, p. 250-259.

S.A.P. (sintered aluminum powder) produced from pure aluminum powder of prescribed particle size and oxide content has a range of special properties; it does not recrystallize, and neither its fatigue nor static strength fall to zero even after prolonged heating up to about 500° C. In these respects it is about five times better than all other aluminum alloys around 400° C. It also has considerably higher electrical and thermal conductivities and lower thermal expansion than aluminum alloys. It corrosion resistance is about that of pure aluminum. 49 ref. (Q27a, Q7a, P11, P15g, 2-12; Al. 6-22)

506-Q. (German.) **Structure, Hardness, Notch-Impact Strength and Magnetic Saturation of Heat Resistance Chromium-Manganese Steels With 2 to 6% Ni.** Helmut Krainer. *Archiv für das Eisenhüttenwesen,* v. 28, Feb. 1957, p. 81-89.

Investigation of 120 steel samples with 10 to 30% Cr, 3 to 20% Mn and 2.4 to 6% Ni after quenching from 1200° C. in water, after 1000 hr. annealing at 650° C. and after 100 hr. annealing at 800° C. Structure, determination of hardness, notch-impact strength and magnetic saturation. 16 ref. (Q29a, Q6n, M27, P16; AY)

507-Q. (German.) **New Testing Methods for Steel and Welding Materials in Large Welding Construction.** Henri M. Schnadt. *Oerlikon Schweissmitteilungen,* v. 15, no. 26, 1957, p. 5-87.

Theory, characteristics of stress and plastic deformation, neoplastic behavior of metal, behavior of metal under greater plastic deformation, breakage at a certain point, general stress requirements of welded construction, quality evaluation of steel and welding materials. 107 ref. (Q25k, Q23; ST, 7-1)

508-Q. (German.) **The Notch Impact Test.** K. Rühl. *Schweissen und Schneiden,* v. 9, Mar. 1957, p. 83-90.

Design of specimen, factors influencing results, applications for the test. 17 ref. (Q6, 1-4, 1-10)

509-Q. (German.) **Application of Hardness Testing in Welding Practice.** N. Ludwig. *Schweissen und Schneiden,* v. 9, Mar. 1957, p. 98-102.

Correlation with other methods, advantages and limitations, main applications. (Q29; 7-1)

510-Q. (German.) **Material Tests at Low Temperatures.** H. Hildesheimer. *Schweissen und Schneiden,* v. 9, Mar. 1957, p. 117-119.

Purpose of testing, precooling or cooling in the machine, cooling media and devices. 2 ref. (Q general, 1-4, 2-13)

511-Q. (German.) **On the Determination of Young's Modulus on Small Construction Elements.** Wolfram Ruff, Gottfried Meudt and P. Schillmöller. *Zeitschrift für Metallkunde,* v. 48, Mar. 1957, p. 119-125.

Very small extension can easily be determined with the pneumatic extensometer, thus being applicable to Young's modulus measurements. Straight bars and piston rings of steel, gray cast iron and light metals were used. 5 ref. (Q21a, 1-3; ST, CI, EG-a39)

512-Q. (German.) **Investigations of the Structure and the Strength Characteristics of Die Forgings From Al-Cu-Mg and Al-Zn-Cu-Mg Alloys.** Wilhelm Rosencranz. *Zeitschrift für Metallkunde,* v. 48, Feb. 1957, p. 41-53.

Investigation of the influence of the press type (hydraulic, toggle lever and screw press) and of the forging temperature and the solution annealing (salt bath and air circulation) on the microstructure and on the static and dynamic strength values. Quality of different forgings. 2 ref. (Q27a, M28k, F22; Al)

513-Q. (Russian.) **Some Properties of Alloys of Zirconium With Columbium.** Yu. F. Bychkov, A. N. Rozanov and D. M. Skorov. *Atomnaya Energiya,* v. 2, Feb. 1957, p. 146-151.

The constitutional diagram of the system zirconium-columbium constructed on the basis of the experimental data obtained. The results of elongation tests to which zirconium-columbium alloys have been subjected at room temperature. The heat resistance of these alloys was evaluated by measuring their hardness at 750° C. and also by determining the changes in this hardness occurring as a result of low-temperature tempering (aging). The data obtained are interpreted on the basis of the constitutional diagram. The heat resistance of alloys which oxidize in air at 570 and 650° C. has been determined. (Q27a, Q29n, 2-12; M24a; Zr, Cb)

514-Q. (Russian.) **Young's Modulus of Alloys of Zirconium With Columbium.** Yu. F. Bychkov, A. N. Rozanov and D. M. Skorov. *Atomnaya Energiya,* v. 2, Feb. 1957, p. 152-156.

Results of measuring the Young's modulus of zirconium-columbium alloys in vacuum at temperatures up to 950° C. Elasticity also measured

at room temperature after various types of heat treatment. (Q21a, 1-4, 2-14; Zr, Cb)

515-Q. (Book.) **Introduction to Plasticity.** Aris Phillips. 229 p. 1956. Ronald Press Co., 15 East 26th St., New York, N. Y. $7.

An introduction to the rapidly developing field of metal plasticity for the advanced undergraduate and graduate student of engineering and the practicing engineer. Plastic bending and the procedure of superposing perfectly plastic materials explained in detail, deflections of statically determinate and indeterminate beams and frames considered, increment theory and the results obtained by experimental data discussed, and limit design of structures in the presence of combined stresses explained. (Q23)

Corrosion

156-R. Preventation of Corrosion in Packing and Storage. E. L. I. Evans and E. G. Stroud. *Chemistry and Industry,* no. 9, Mar. 2, 1957, p. 242-248.

Preventing corrosion of metals in storage and transit; controlling factors in atmospheric corrosion such as metal-gas reaction, metal-liquid reaction and the corrosion product and solid contaminant. 29 ref. (R10e, R3)

157-R. Cathodic Protection of the Coated Steel. Gas Main Distribution System in New Orleans. Sidney E. Trouard. *Corrosion,* v. 13, Mar. 1957, p. 21-31.

Includes information on topography and soils, pipes of gas mains, use of coatings, galvanic anodes, rectifiers, ground beds and insulated joints. Satisfactory protection secured. (R10d, R8; ST, 4-10)

158-R. Corrosion Control System for Underground Cables in Conduit in a Stray Current Metropolitan Area. Edward P. Teale. *Corrosion,* v. 13, Mar. 1957, p. 35-42.

Investigation indicated the single drainage wire no longer gives adequate protection due to subsurface conditions. Problems overcome by use of controlled rectifier employing two stages of magnetic amplification maintaining current drainage at minimum value required by potential difference between cable and earth. (R8, R10d, T7)

159-R. Corrosion of Steel in a Reinforced Concrete Bridge. R. F. Stratfull. *Corrosion,* v. 13, Mar. 1957, p. 43-48.

Studies of bridge exposed to salt water environment showed high permeability of concrete with low effectiveness in restricting moisture and air from steel, resulting in macrogalvanic corrosion. Resistivity measurements of concrete indicated anodic areas probably were created by larger moisture or sea salt content. (R4b, T26p; ST)

160-R. Evaluation of Cooling Tower Corrosion Inhibitors. W. L. Denman and Charles B. Friedman. *Corrosion,* v. 13, Mar. 1957, p. 49-55.

Experiments with chromate and polyphosphate inhibitors using steel test coupons demonstrated effectiveness of small pilot tower in the evaluation of corrosion inhibitors for cooling water. (R10b, R4; ST)

161-R. Polyvinylidene Chloride Film and Microcrystalline Wax for Protecting Underground Pipe. Ted Kennedy, Jr. *Corrosion,* v. 13, Mar. 1957, p. 56-60.

Case histories indicate effectiveness of wax and film protection in preventing corrosion. (R8, L26q; 4-10)

162-R. Testing of Coal Tar Coatings. Pt. II. Field Exposure in Cold Climates. W. F. Fair, C. U. Pittman and M. G. Sturrock. *Corrosion,* v. 13, Mar. 1957, p. 61-64.

Details of an experiment are given in which 10-ft. lengths of pipe were buried in Canada at depths of 1 through 5 ft. after application of five systems of coatings and wrappings on groups of five pipes each. Pipes were buried after testing with an electronic holiday detector with self-registering thermometers in two pipes at each level. After a year's exposure the pipes were unearthed and tested electrically for holidays. (R8, L26a; 4-10)

163-R. Effect of Ultraviolet Irradiation on the Growth of Anodic Ta_2O_5 Films. D. A. Vermilyea. *Electrochemical Society Journal,* v. 104, Apr. 1957, p. 212-217.

Ultraviolet irradiation during the growth of amorphous tantalum oxide films in aqueous solutions results in the transformation of the outer portion of the film from tantalum oxide to a material which dissolves more rapidly than tantalum oxide in hydrogen fluoride. If the formation field is high, the transformed region has a very high resistance and both tantalum and oxygen are mobile in the region. When the formation field is low, the region has a lower resistance, contains water which can be removed partially by heating the film in air, and only oxygen is mobile. (R1h; Ta)

164-R. Oxidation of 50 Weight Per Cent Uranium-Zirconium Alloy. Sidney Barnartt, Robert G. Charles and Earl A. Gulbransen. *Electrochemical Society Journal,* v. 104, Apr. 1957, p. 218-221.

The reaction of 50% uranium-zirconium with oxygen at 1 atm. pressure was studied over the range 200-500° C. Two forms of the alloy, tne stable epsilon phase and the quenched gamma phase, were reacted to an oxide-scale thickness of 0.1 mm. at the higher temperatures. In general, the weight gain increased linearly with time, although in many cases the oxidation curve showed a bend and could be represented by two straight lines. At 400° C. and above, the stable epsilon phase reacted considerably faster than the gamma phase. 14 ref. (R1h; U, Zr)

165-R. Coatings: Vital Part of Corrosion Prevention. *Gas,* v. 33, Mar. 1957, p. 50-54.

Brief discussion of corrosion phenomena and coating system. (R general, L general; 4-10)

166-R. Corrosion Mitigation in Congested Areas. F. E. Kulman. *Gas,* v. 33, Mar. 1957, p. 60-61.

Problems on stray currents, pipe materials, insulating joints and cathodic protection. (R10; 4-10)

167-R. Stress-Corrosion of Austenitic Stainless Steels in Chemical Plant Equipment. William C. Rion. *Industrial and Engineering Chemistry,* v. 49, Mar. 1957, p. 73A-78A.

Some case histories of condenser, heat exchanger and cooling coil failures, failures caused by contact of heated stainless steel with wet thermal insulation. (R1d, T29; SS)

168-R. Here's Why Underground Pipe Corrodes. *Oil and Gas Journal,* v. 55, Mar. 11, 1957, p. 133-135.

Simple explanation of the galvanic corrosion of pipe. (R8)

169-R. Resistance of Titanium to Sulfuric and Hydrochloric Acids Inhibited by Ferric and Cupric Ions. J. R. Cobb and H. H. Uhlig. Massachusetts Institute of Technology. Technical Report 6 Under Contract N5 Ori-07815. *U.S. Office of Technical Services,* PB 123144, June 1951, 10 p. (CMA)

Ferric and cupric ions inhibit titanium corrosion in boiling media such as 10% hydrochloric or 10% sulphuric acid. Amounts of 0.005 mole per liter are effective, lowering the corrosion rate to 0.012 in. per year. The consumption of inhibitor with corrosion is moderate, especially at higher concentrations. The main mechanism of inhibition seems to be surface adsorption of the ions. (R6g, R10b; Ti)

170-R. (French.) **Induced Formation of Epitatic Oxide Films on Alpha Uranium by Atmospheric Oxidation and Anodic Oxidation.** A. Robillard and P. Lacombe. *Journal de Chimie Physique et de Physico-Chimie Biologique,* v. 53, Oct. 1956, p. 798-802.

Microscopic view of relative orientation of crystals; bands of deformation; kinetics of oxidation and function of the crystalline orientation; structure of alpha uranium; defines the conditions for the preparation of uranium surfaces which permit the formation of epitatic oxide films. 9 ref. (R1h, M26; U)

171-R. (Russian.) **Influence of Asymmetrical Loading Upon the Corrosion Fatigue Resistance of Pumping Rods.** R. M. Raskin and R. A. Bagramov. *Vestnik Mashinostroeniia,* v. 37, no. 1, Jan. 1957, p. 28-30.

Experiments show that during corrosion fatigue, the over-all amplitude of steel 40 U pumping rods remains constant with an increase of asymmetry. With increasing asymmetry of the cycle, the relative lowering of corrosion-fatigue resistance diminishes. 3 ref. (R1e; ST)

172-R. Corrosion Prevention of Railroad Equipment. J. W. Crossett. *American Society of Mechanical Engineers, Preprint,* no. 57-RR-1, Apr. 1957, 6 p.

Some of the problems contributing to corrosion loss on diesel electric locomotives, passenger equipment and freight cars: remedies to minimize these losses. (R general, T23)

173-R. Oxidation of 50 Weight Per Cent Uranium-Zirconium. S. Barnartt, R. G. Charles and E. A. Gulbransen. *Electrochemical Society Journal,* v. 104, Apr. 1957, p. 218-221. (CMA)

Oxidation at 1 atm. was studied in the range 200-500° C. for both the stable epsilon-phase and the quenched gamma-phase. Weight gain increased linearly with time for the greater part of the curve. The epsilon-phase reacts faster than the gamma-phase above 400° C. The thick scales were porous and enriched in uranium. The rate law was parabolic in the 200-250° C. range for thin oxide films. Oxidation is faster than with pure zirconium. 14 ref. (R1h; Zr, U)

174-R. Oxidation of Zirconium Between 400 and 800° C. E. A. Gulbransen and K. F. Andrew. *Journal of*

Metals, v. 9, no. 4, Apr. 1957, p. 394-400. (CMA)

Abraded and chemically polished zirconium samples were subjected to oxidation in the range 400-800° C.; the vacuum microbalance was used. The cubic rate law fits the data on abraded samples best; however, disregarding an initial deviation permits application of the parabolic law, which is also applicable to the chemically polished samples. The activation energies above and below 525° C. are 28,600 and 18,200 cal. per mole, respectively. Data fit in with analyses of higher and lower ranges. Entropies of vacancy formation and vibration frequencies of zirconium dioxide bonds are indicated. (R2h, P12s; Zr)

175-R. Temporary Rust Preventives. Edgar S. Lower and S. C. Cressey. *Machinery*, v. 90, Mar. 8, 1957, p. 537-540.

Majority formulated on basis of lanolin; types of films, pretreatment of surfaces, application of preventive, wrapping of treated parts and removal of preventive. (R10f)

176-R. Statistical Analysis of the Corrosion of Uranium. Pt. 1. Tests in Moist Helium and the Effects of Impurities. James T. Waber. Los Alamos Scientific Laboratory. *U.S. Atomic Energy Commission*, LA-1355, Jan. 31, 1952, 23 p.

Rate data concerning the corrosion of uranium have been treated statistically. A partial analysis of the effect of impurities has been made. The methods and equations are briefly explained. (R11, 3-19; U)

177-R. High-Temperature Oxidation and Contamination of Niobium. William D. Klopp, Chester T. Sims and Robert I. Jaffee. Battelle Memorial Institute. *U.S. Atomic Energy Commission*, BMI-1170, Feb. 19, 1957, 22 p.

The oxidation and contamination rates of columbium in oxygen and in air were measured in the temperature range 600 to 1200° C. The oxidation curves in oxygen were linear and the rate constants were correlated by an Arrhenius-type plot. 13 ref. (R2h; Cb)

178-R. Climatic Extremes for Military Equipment. N. Sissenwine and A. Court. Office of the Quartermaster General, Department of the Army. *U.S. Office of Technical Services*, PB 121741, Nov. 1951, 70 p. $1.75.

Environmental stresses studied were thermal, humidity, precipitation, wind, penetration and abrasion, salt spray and atmospheric pressure. Probable and practical extremes were determined for each. Conditions were established for design and evaluation of military equipment for use under world-wide, hot desert, arctic winter, and moist tropical climatic extremes. (R3, T2)

179-R. (German.) **Corrosion Resistance of High-Purity Aluminum.** E. Nachtigall. *Aluminium*, v. 33, Feb. 1957, p. 95-100.

Corrosion of high-purity aluminum occurring at temperatures over 100° C., and at high pressure (conditions existing in nuclear reactors) is intergranular. It decreases as the degree of hardness (produced by cold working) increases, and it is also relatively low in cast metal. This corrosion cannot be prevented by chemical or anodic surface conditioning, but it can be inhibited by the addition of a mixture of alkaline chromate and alkaline silicate to the water. (R4a, R10b; Al-a)

180-R. Corrosion Mechanisms in the Plain Can. E. L. Koehler and C. M. Canonico. *Corrosion*, v. 13, Apr. 1957, p. 19-29.

Study of the various factors and mechanisms involved in the corrosion of plain tin-coated steel cans containing peaches or prune juice. Include such items as amount of hydrogen evolved, amount of tin and steel dissolved, potential relationships, protective currents and polarization characteristics of coupled tin and steel. (R7n, R1a; CN, *Sn*, 8-15)

181-R. Corrosion Measurements in a Hydrogen Sulfide-Water Absorption Pilot Plant. B. W. Bradley and N. R. Dunne. *Corrosion*, v. 13, Apr. 1957, p. 30-34.

Tabulates corrosion rates for carbon steel and effect of amine type inhibitor on rate. Killed carbon steel, Stainless Type 304, Inconel, "K" Monel and other alloys were evaluated as to corrosion rate, sulphide stress cracking resistance and performance with corrosion inhibitor present. (R10b; CN, SS, Ni)

182-R. Effect of Dissolved Oxygen on Corrosion of Steel and on Current Required for Cathodic Protection. E. Schaschl and G. A. Marsh. *Corrosion*, v. 13, Apr. 1957, p. 35-43.

Study of interrelationship of corrosion rate of steel, dissolved oxygen concentration, agitation, electrode potential, cathodic protection, current density. Suggests that corrosion proceeds by chunk removal of metal at low pH and discusses importance of differential aeration in corrosion of buried structure. 26 ref. (R10d; ST)

183-R. Case History in Cooling Water Treatment. C. J. Holland, Jr., and W. A. Tanzola. *Corrosion*, v. 13, Apr. 1957, p. 49-54.

History and problems in preventing deterioration and corrosion by the use of controlled pH and phosphate and chromate inhibitors. (R10b)

184-R. Special N-80 Steel Tubing Developed in France to Resist Sulfide Stress Corrosion in Sour Gas Wells. L. Cauchois, J. Didier and E. Herzog. *Corrosion*, v. 13, Apr. 1957, p. 55-61.

Data from mechanical property and corrosion tests and use as tubing at corrosion gas wells indicated strength and stress-corrosion resistance of APS 10 M4; a chromium-aluminum-molybenum alloy steel. (R1d, R7a; AY, 4-10)

185-R. Effect of Variables in Laboratory Testing of Corrosion Inhibitors for Refined Petreloum Products. David B. Boies and J. I. Bergman. *Corrosion*, v. 13, Apr. 1957, p. 69-74.

Variables studied to determine the effect of inhibitor performance include degree of agitation, concentration of dissolved solids in water phase, the pH, temperature, oxygen content and nature of hydrocarbon phase. (R10b, R11)

186-R. Fly Ash Prevents Corrosion. W. C. Thompson. *Electrical World*, Apr. 15, 1957, p. 84.

Iron pipe buried in soil is protected against corrosion when it is embedded in fly ash. An analysis of the fly ash is given. (R10a)

187-R. Causes of Corrosion and Prevention With Pipe Wrap. Laurence P. Benedict. *Gas Age*, Apr. 4, 1957, p. 40-41.

Two most common causes are galvanic and stray current. Method for protection using polyvinyl chloride tape as wrapping. (R10b, R1a)

188-R. Cathodic Protection in Pulp and Paper Mills. Joseph A. Lehman. *Paper Trade Journal*, Apr. 15, 1957, p. 64-68.

Cathodic protection and its application to the paper industry. (R10d, T29r)

189-R. Preventing Corrosion by Crude. Use of Surface-Active Agents. D. Bass. *Petroleum*, v. 20, Apr. 1957, p. 139-142.

The petroleum engineer now has a wide range of chemical inhibitors at his disposal for use in combating corrosion. Of these, the organic inhibitors derived from natural fats are finding wide application. Discussion of the use of cationic surface-active agents to combat corrosion due to crude oil both at the oil well, with particular reference to water injection techniques and at the refinery. (R7a, R10b)

190-R. Logarithmic Transformations in the Analysis of Corrosion Data. H. C. Bowen, C. Groot and J. L. Leach. Hanford Atomic Products Operation, Richland, Wash. *U.S. Atomic Energy Commission*, HW-48753, Feb. 18, 1957, 10 p.

Logarithmic transformation of corrosion data can give constant variance and additive effects and turn a hopelessly complex system into a simple one. (R11, S12j)

191-R. Oxidation of Titanium and Titanium Alloys. D. W. Stough, F. W. Fink and R. S. Peoples. Battelle Memorial Institute. Report 29. *U.S. Office of Technical Services*, PB 124566, Jan. 1956, 68 p. (CMA)

Scaling behavior in pure oxygen of titanium and its alloys depends on a different rate law for each of the ranges 80-570° F., 570-1000° F. and 1100-1800° F. The oxidation rate increases with temperatures and becomes important in the 1100-1800° F. range. The alloys with iron, chromium, manganese or vanadium scale faster than pure titanium. (R1h, R2q, 2-11, 2-10; Ti)

192-R. (English.) **Corrosion of Lead Sheath in Manhole Water.** *Nippon Telegraph and Telephone Public Corp., Electrical Communication Laboratory, Reports*, v. 4, Nov. 19, 1956, p. 5-10.

Results of field tests and recommendations for corrosion prevention. (R4f; Pb)

193-R. (French.) **Topochemical Study of Corrosive Phenomena.** W. Feitknecht. *Corrosion et Anticorrosion*, v. 5, Feb. 1957, p. 36-50.

Electrochemical, thermodynamic and topochemical aspects of corrosion. Method of topochemical examination which permits analysis of complex corrosive phenomena by the study of solid corrosive products which play an essential role in the development of corrosion. Use of the electronic microscope and diffraction of X-rays for the identification and specification of the texture of weak corrosion products and superficial films. 25 ref. (R11a, 1-3)

194-R. (French.) **Study of the Evolution of Characteristics of Sea Water in a Corrosion Testing Station.** L. Barriety, J. Debyser and A. Hache. *Corrosion et Anticorrosion*, v. 5, Feb. 1957, p. 51-57.

Endeavor to determine the influence of the phenomenon of photosynthesis on the corrosive activity of steel by sea water. Analyzes the influence of temperature, pH and oxygen content of sea water. 7 ref. (R4b, R11)

195-R. (French.) **Work on Corrosion Undertaken by the British Iron and Steel Research Association.** J. C. Hudson. *Corrosion et Anticorrosion,* v. 5, Mar. 1957, p. 69-75.

Summary of almost 30 years' research activity, covering atmospheric corrosion, influence of climate, corrosion in sea water and potable water, and corrosion in the ground. (To be continued.) (R general, A9)

196-R. (French.) **Concerning the Mechanism of Intercrystalline Corrosion of Soft Steel by Ammonium Nitrate.** M. Smialowski and T. Ostrowska. *Corrosion et Anticorrosion,* v. 5, Mar. 1957, p. 76-81.

Samples of iron with small and large crystals were submitted under tension to the action of ammonium nitrate solutions. Verifies that monocrystal samples reveal a stronger cathodic polarization than polycrystalline samples, and that the grains show great differences in their cathodic polarization capacity, as a function of their crystallographic orientation. 10 ref. (R2h, R6j, 3-21; CN)

197-R. (German.) **Corrosion Resistant Alloys.** Ernst Brunhuber. *Giesserei-Praxis,* v. 75, Mar. 10, 1957, p. 105-108.

Tabulation of corrosion resistant alloys and corresponding corroding agents. (R general; SGA-g)

198-R. (German.) **Electrochemical Corrosion of Nonferrous Alloys.** H. Vosskühler. *Metall,* v. 11, Mar. 1957, p. 193-196.

Electrochemical corrosion possible only when intercrystalline and transcrystalline fracture surface is anodic to the rest of the crystal surface. Explanation of the corrosion mechanism. 16 ref. (R1; EG-a)

199-R. (German.) **Effect of Inhibitors and Wetting Agents on the Corrosion of Iron in Dilute Sulphuric Acid.** W. Machu and Solomon El Gendi. *Metalloberfläche,* v. 11, Apr. 1957, p. 135-139.

Use of aryl-alkyl derivatives of dodecylsulphonates in dilute sulphuric acid. Action of inhibitors can be positively or negatively influenced by wetting agents. 9 ref. (R6g, R10b; Fe)

200-R. (German.) **Oxidation of Germanium.** Oscar Rösner. *Zeitschrift für Metallkunde,* v. 48, Mar. 1957, p. 137-141.

Single crystals of germanium are less oxidized than polycrystals of equal purity and the oxidizability of germanium decreased with increasing purity in various agents such as water, air, carbon dioxide, etc. 7 ref. (R1h; Ge)

201-R. (Book—German.) **Corrosion and Wear of Steels and Their Control in Steam Generating Plants and in Machine and Vehicle Construction.** G. W. Akimow. 160 p. 1956. VEB Verlag Technik, Unter den Linden 12 (Russian Sector), Berlin NW 7, Germany.

Protection of steel from corrosion fatigue; investigations in the field of intercrystalline stress-corrosion of boiler steels; investigation of corrosion resistance of boiler steels against high-temperature steam; testing of inhibitors against jamming of detachable machine parts at high temperatures; effect of the surface machining on the corrosion resistance of steel; investigation of the influence of different procedures of surface machining on the corrosion tendency of steel by plotting of polarization curves; repair of automotive parts by chromium plating. (R4d; ST)

8 Inspection and Control

181-S. Use of an Air Jet in the Spectrographic Analysis of Low Alloy Steel. D. L. Fry and T. P. Schreiber. *Applied Spectroscopy,* v. 11, no. 1, 1957, p. 1-6.

Investigation of the function of an air jet blown through the analytical gap and its value in increasing the reproducibility and accuracy of analytical results. (S11k; AY)

182-S. Chemical Analysis of Cupola Slags. Pt. 1. Determination of Alumina. (a) Fluoride Volumetric Method. W. E. Clarke. *British Cast Iron Research Association Journal,* v. 6, Feb. 1957, p. 505-511.

Direct fluoride volumetric method for determination of alumina. (S11j; RM-q, *Al*)

183-S. Effect of Chromium in the Bismuthate Method for the Determination of Manganese. W. E. Clarke and W. B. Shaw. *British Cast Iron Research Association Journal,* v. 6, Feb. 1957, p. 512-518.

Found that chromium up to 5% did not interfere, provided excess sulphurous acid added after first bismuthate oxidation to insure reduction of all chromate formed. (S11; *Mn, Cr*)

184-S. Metallurgy of Cutting Tools. Pt. V. Tool Life Evaluation and Failure. K. G. Lewis. *Iron and Coal Trades Review,* v. 174, Mar. 8, 1957, p. 569-571.

Discussion of flank wear, criteria of tool life, methods of evaluating tool life, types of tool failure. (S21, T6n)

185-S. Inspection Equipment for Sapphire Jets. T. E. W. Preston. *Metalworking Production,* v. 101, Feb. 22, 1957, p. 315-320.

Pantographic device and "Sigma Multihead" system for blade and disk measurements. Magnetic crack detector and other equipment used by Armstrong-Siddeley in inspection of jet engine parts. (S13, S14, T24b)

186-S. How Non-Destructive Testing Aids Power Station Maintenance. Joseph L. McParlan. *Power Engineering,* Mar. 1957, p. 57-60.

Nondestructive testing is an important part of the preventive maintenance program. Tests using plain and fluorescent magnetic particles, fluorescent and dye penetrants, ultrasonic vibrations and gamma radiations are discussed. (S13, W11, 18-21)

187-S. (French.) **Colorimetric Method for the Determination of Uranium by Means of Dibenzoylmethane.** P. Blanquet. *Analytica Chimica Acta,* v. 16, Jan. 1957, p. 44-56.

The complex is formed in aqueous pyridine in the presence of EDTA and tartaric acid; the optical density is measured at 415 mμ. The method involves only one filtration and has been applied with satisfactory results to the analysis of pitchblende, antunite and thorianite, etc., containing from 0.05 to 25% uranium. (S11a; U)

188-S. (German.) **Use of Isotopes in the Metallurgy and Metallography of Nonferrous Metals.** G. Glawitch. *Schweizer Archiv,* v. 23, Jan. 1957, p. 24-27.

Use of isotopes in testing of tools, for thickness measurements, as well as in analysis of metals. 5 ref. (S14e, S11q, M23q; 14-13)

189-S. (Italian.) **Examples of Quality Evaluation in Steel Production.** M. Casadio. *Atti Notizie* (Monthly Bulletin of Italian Metallurgical Assoc.), incorporated in *Metallurgia Italiana,* v. 11, Dec. 1956, p. 404, 418.

Brief description of some of methods used by firm of Cogne, S. p. A., to evaluate quality of melts of alloy steels; data obtained used to judge homogeneity of production. (S general, D general; ST)

190-S. (Russian.) **Quantitative Determination of Beryllium With the Aid of Radioactive Iron.** S. V. Bleshinskiy and V. F. Abramova. *Primeneniye Mechenykh Atomov v Analiticheskoy Khimii,* 1955, p. 37-44.

Method by precipitating the metal in the form of the double oxalate ($K_2C_2O_4 \cdot BeC_2O_4$) and dissolving the precipitate in the presence of a salt of radioactive iron-59. The reduction in the radioactivity of the solution depends on the amount of precipitate that has gone into solution. (S11q, Be, Fe)

191-S. (Russian.) **Fluoride Method for the Quantitative Determination of Beryllium.** S. V. Bleshinskiy and V. F. Abramova. *Primeneniye Mechenykh Atomov v Analiticheskoy Khimii,* 1955, p. 45-57.

On the basis of experimental work an accelerated method for the determination of beryllium in beryl or concentrates is recommended. (S11; Be)

192-S. (Russian.) **Quantitative Determination by Radioactivation Analysis of the Content of Impurities in Germanium.** I. P. Alimarin, Yu. V. Yakovlev and A. I. Zhabin. *Primeneniye Mechenykh Atomov v Analiticheskoy Khimii,* 1955, p. 58-69.

Principles of radioactivation analysis in general. Determination of rare earth elements, antimony, molybdenum, copper and zinc in germanium is described in detail. (S11q; Ge, 9-1)

193-S. (Russian.) **Application of Radioactive Tracers in the Chromatographic Separation of Rare Earths.** D. I. Ryabchikov and M. M. Senyayin. *Primeneniye Mechanykh Atomov v Analiticheskoy Khimii,* 1955, p. 98-106.

Procedures for the chromatographic separation of rare earths with the aid of radioactive tracers (radioactive isotopes of rare earth elements). A complete scheme for the separation of rare earths by methods which are partly chemical and partly chromatographic is shown. Equipment which has been designed by the authors and their collaborators and used in work of this type is described. (S11q; EG-g)

194-S. (Russian.) **Separation of Spectrally Pure Cerium From Natural Mixtures by the Extraction Method.** V. M. Klinayev and M. M. Senvavin. *Primeneniye Mechenykh Atomov v Analiticheskoy Khimii,* 1955, p. 118-126.

Separation of cerium from other rare earths by extraction of a nitric acid solution with ether investigated on the basis of a finding made by L. Imre. It was established that 90-95% of the cerium is extracted and that this cerium is pure; no other rare earth elements are extracted. Extraction of cerium by this method simplifies the chromatographic separation of the remaining elements of the mixture. (S11f; Ce)

195-S. (Russian.) **Ion-Exchange Separation of the Activities of Rare-Earth Elements Without the Application of pH-Meter.** B. K. Preobrazhenskiy, O. M. Lilova, A. N. Dobronravova and Ye. D. Teterin. *Zhurnal Neorganicheskoy Khimii,* v. 1, Oct. 1956, p. 2294-2299.

Lactic acid solutions were used, the effectiveness of which as eluants was regulated by diluting the solution to the requisite degree. Changes of pH and of eluant capacity during storage were thereby avoided and complete dissociation of the lactic acid brought about, because ammonium lactate is completely ionized, while lactic acid is not. (S11f; EG-g)

196-S. Determination of Titanium in Plutonium-Titanium. K. S. Bergstresser. *Analytical Chemistry,* v. 29, Apr. 1957, p. 532-534. (CMA)

Titanium in plutonium-titanium alloys may be determined colorimetrically from the hydrogen peroxide complex. Hydrogen peroxide is added to a $HClO_4$ solution of the alloy and the precipitate formed with plutonium is removed prior to the estimation. Titanium may be determined in the range 0.1-1.0%. Columbium and uranyl ion interfere. 6 ref. (S11a; Ti, Pu)

197-S. Separation and Determination of Microgram Quantities of Zirconium. C. E. Bricker and G. R. Waterbury. *Analytical Chemistry,* v. 29, Apr. 1957, p. 558-562. (CMA)

Micro-amounts of zirconium are separated from solutions containing diverse metallic ions, especially plutonium alloys, by precipitation with p-bromomandelic acid. The presence of polyvalent ions exerts a beneficial effect. A single precipitation is often insufficient for complete separation of zirconium. NH_2OH:HCl is added to prevent the precipitation of plutonium (IV) tetra-p-bromomandelate. Chloranilic acid is used as the colorimetric agent in 1.4*N* $HClO_4$. (S11a; Zr)

198-S. The Analysis of Thorium-Cerium Binary Alloys. G. W. C. Milner and G. W. Sneddon. *British Atomic Energy Research Establishment,* C/R 1740, Sept. 1955, 16 p. (CMA)

Alloys of thorium with 1-99% cerium may be analyzed titrimetrically following dissolution in hydrochloric acid and evaporation to fumes of $HClO_4$. Cerium is determined by oxidation with $(NH_4)_2S_2O_8$ and titration with $Fe(NH_4)_2(SO_4)_2$; ferroin is the indicator. Thorium is determined in a separate aliquot without separation from cerium. 15 ref. (S11j; Th, Ce)

199-S. Separation of Heavy Metals With Acid Alkyl Phosphate and Phosphonate Resins. J. Kennedy, R. V. Davies and B. K. Robinson. *British Atomic Energy Research Establishment,* A.E.R.E. C/R 1896, Mar. 1956, 5 p.

Di-alkyl phosphate resin in the hydrogen and sodium form in conjunction with inorganic acids and disodium ethylene di-amine tetra acetate as eluting agents has been successfully employed in the separation of hexavalent uranium from alkaline earths, divalent transitional, trivalent iron and lanthanide elements. Separation from tetravalent cations such as zirconium and thorium was not complete. 6 ref. (S11f; U, EG-f)

200-S. Spectrographic Determination of Molybdenum, Beryllium, Iron, Chromium and Nickel in Bismuth and Bismuth-Uranium Alloys. M. J. Owers and M. S. W. Webb. *British Atomic Energy Research Establishment,* A.E.R.E. C/R 2115, Dec. 1956, 9 p.

Bismuth metal or alloys are converted to oxide, cobalt and vanadium incorporated as standards and 70-mg. charges burnt to completion in cupped graphite electrodes. The resulting spectra are evaluated for molybdenum, beryllium, iron, chromium and nickel over the range 1 to 200 ppm. by microphotometry, and, with the exception of iron, sensitivities of 1 ppm. or better are attained. 7 ref. (S11k; Bi, U, *Mo, Be, Fe, Cr, Ni*)

201-S. Rapid Analytical Techniques at Canadian Exploration Limited. B. Wilson. *Canadian Mining and Metallurgical Bulletin,* v. 50, Mar. 1957, p. 143-146. (*Transactions,* v. 60, 1957, p. 85-88.)

Analyses in treatment of tungsten and lead-zinc ore include polarographic determination of lead, zinc and cadmium and spectrophotometric method for tungsten; procedures for phosphorus and sulphur. (S11, W, Zn, Pb, RM-n)

202-S. Determination of Precious Metals in Ores. Clyde L. Lewis. *Canadian Mining and Metallurgical Bulletin,* v. 50, Mar. 1957, p. 163-167.

Examination of reproducibility of results of fire assay method for collection of gold, silver, platinum, palladium and rhodium for spectrographic analysis indicated, despite wide variation in fire assay techniques, that results were not significantly affected. 16 ref. (S11s, RM-n, *EG-c*)

203-S. Spectrographic Analysis of Low-Alloy Steel—a Plate Calibration Technique Based on Relative Intensities of Standard Iron Lines. T. G. Shamanna and N. P. Gandhi. *Indian Institute of Metals, Transactions,* v. 8, 1954-55, p. 309-317.

The method of plate calibration commonly used by sparking analyzed standards on each plate has several drawbacks. Another method whereby the photometer deflection ratios are converted into intensity ratios offers distinct advantages and is to be preferred for routine work. Testing the suitability of this method of plate calibration for the analysis of low-alloy steels; description of the technique used and the results obtained which fully confirm the theoretical soundness of the method. (S11k; AY)

204-S. Spectrographic Analysis of High-Alloy Steels. T. G. Shamanna and P. N. Gandhi. *Indian Institute of Metals, Transactions,* v. 8, 1954-55, p. 319-332.

In the present investigation, the concentration-ratio method is applied for the analysis of high-alloy steels such as high-speed, stainless and toolsteels. The concentration-ratio method essentially consists in taking the variation in the base metal content into account by plotting the log concentration ratio of the alloying elements to the base metal instead of the log percentage of the alloying elements, in drawing the working curves which are employed for the analysis of a number of steels of widely varying composition. (S11k; AY)

205-S. Analysis of Corrosion Products by Paper Chromatography. D. G. Stern and F. Corry. *Metal Treatment and Drop Forging,* v. 24, Mar. 1957, p. 93-97.

Method allows detection of metal in smaller than microgram amounts. Procedure for preparing chromatograms; locating and identifying zones. (S11a, R11)

206-S. The Photometric Determination of Molybdenum in Zinc Cyanide Plating Solutions. J. P. Leftin. *Plating,* v. 44, Apr. 1957, p. 380-382. (CMA)

Molybdenum may be quickly and accurately determined photometrically in zinc cyanide plating solutions, since only small concentrations are present. Small amounts of molybdenum are added to zinc cyanide plating solutions for the purpose of producing a bright zinc plate. The thiocyanate is destroyed and fresh stannous chloride is used to reduce the molybdenum. Butyl carbitol is used to stabilize the color. The preparation of the standard curve is described for the range 0-0.45 oz. per gal. of molybdenum. (S11a, L17a; Zn, *Mo*)

207-S. Plucking Millionths Out of Thin Air. Jack Ritchie. *Tooling and Production,* v. 22, Mar. 1957, p. 83-87.

Description of Fringecount micrometer which employs interferometry in combination with digital counting for measuring directly in number of half wave lengths; instrument gives exceedingly accurate check on dimensions of gage block, plug gages, etc. (S14, X20)

208-S. Gravimetric Determination of Barium in Zirconium Metal and in Certain Zirconium Salts. L. Silverman and K. Trego. *U.S. Atomic Energy Commission,* NAA-SR-1720, Mar. 1956, 17 p. (CMA)

Barium in zirconium and zirconyl chloride may be determined gravimetrically as the sulphate after removing the interfering zirconium and iron. The zirconium is removed by a double precipitation in a 3:1 hydrochloric acid medium and final extraction with cupferron and chloroform. (S11b, *Ba,* Zr)

209-S. Determination of Iron, Chromium, and Nickel by X-Ray Fluorescence, Aqueous Solution Method. Louis Silverman and William W. Houk. North American Aviation, Inc. *U.S. Atomic Energy Commission,* NAA-SR-1788, Mar. 15, 1957, 12 p.

The iron, chromium, and nickel contents in many types of stainless steels were determined by X-ray fluorescence. The fluorescence data were obtained for specific K alpha lines and the intensities were compared to the background intensity reading obtained at 0.6 Å, and the values obtained from a standard plot. The curves obtained for stainless steels are applicable to certain chromium-nickel alloys. (S11p; SS, *Fe, Cr,* Ni)

210-S. Chemical Analysis of Traces of Platinum in 7% Uranium-Zirconium. V. F. Consalvo and J. Rynasiewicz. *U.S. Atomic Energy Commis-*

sion, KAPL-M-JR-9, Jan. 24, 1957, 6 p. (CMA)

The acid-insoluble platinum is ashed and dissolved in aqua regia. After some further treatment the platinum is determined colorimetrically by the stannous chloride method. 2 ref. (S11a; U, Zr, *Pt*)

211-S. Gamma Absorptionmetric Sedimentation Analysis in Liquid Metal-Solid Oxide Systems. S. C. Furman. General Electric Co. *U.S. Atomic Energy Commission*, KAPL-1658 (TID-4500, 12th ed.), Jan. 8, 1957, 14 p. $0.20.

A method was developed for determining the concentration and the rate of settling of particulate uranium compounds in NaK or sodium. The method depends on the difference between absorption of gamma radiation by the uranium compound and that by the sodium. (S11f; U)

212-S. Determination of Molybdenum in Uranium-Molybdenum Alloys by Monochromatic X-Ray Absorption. W. C. Dietrich and R. E. Barringer. *U.S. Atomic Energy Commission*, Y-1153, Feb. 21, 1957, 14 p. (CMA)

Uranium alloys with 2-5% molybdenum may be quickly analyzed for the latter by means of monochromatic X-ray absorption. The large excess of uranium seriously attenuates the X-ray beam, so it must be first extracted with tributyl phosphate. Analyses of synthetic samples showed the method to be reliable. (S11p; U, *Mo*)

213-S. Research and Development of Methods of Chemical Analysis for Titanium Metal and Alloys. H. Suss. Watertown Arsenal Laboratory, Report 401/48/A-21. *U.S. Office of Technical Services*, PB 123149, Mar. 1953, 140 p. (CMA)

Status of analytical methods for 29 elements in titanium and titanium alloys. (S11; Ti)

214-S. (Italian.) **Testing With Ultrasonics. Dialogue Between a Steelmaker and a Machinist.** Aldo Bartocci. *Macchine*, v. 12, Feb. 1957, p. 103-108.

Differing points of view on interpretation of defects revealed by ultrasonic testing; difference between fracture and inclusion; reasons for rejection or utilization of a piece of metal. (S13g; ST)

215-S. (Russian.) **Determination of Cadmium in Alloys by the Neutron Absorption Method.** A. P. Ratner, G. R. Rik and A. A. Shebashev. *Primeneniye Mechenykh Atomov v Analiticheskoy Khimii*, 1955, p. 70-74.

Theoretical aspects of analysis based on neutron absorption are expounded. Experimental results are described which show that it is possible to determine cadmium by this method in cadmium-lead alloys when the cadmium content exceeds 2%. Other experimental results show that it is possible to determine the thickness of cadmium coatings on iron when these coatings are more than 10 microns thick. (S11q; Cd)

216-S. (Russian.) **Determination of Zirconium in Ores by the Iodate Method.** Yu. A. Chernikhov and G. I. Kuchmistaya. *Zavodskaya Laboratoriya*, v. 23, no. 1, 1957, p. 14-18. (CMA)

The ore is decomposed by a mixture of hydrofluoric and sulphuric acid, and the mineral zircon, which remains unattacked by the acids, is filtered off and melted with potassium fluoride. After dissolving the melt in sulphuric acid, zirconium is titrated iodometrically. The composition of the precipitate depends on whether it is amorphous or crystalline: amorphous—$2Zr(IO_3)_4 \cdot KIO_3 \cdot 8H_2O$; crystalline-$2Zr(IO_3)_4 \cdot 5KIO_3 \cdot HIO_3$. 9 ref. (S11j; Zr, RM-n)

217-S. (Russian.) **Sulfuration Method of Determining Oxygen. Oxides in Metals—Pt. 2. Determination of Micro-Amounts of Oxygen in Copper, Nickel, Chromium and Molybdenum.** A. K. Babko, A. I. Volkova and O. F. Drako. *Zavodskaya Laboratoriya*, v. 23, no. 2, 1957, p. 136-140. (CMA)

Molybdenum-nickel alloys, copper or nickel (1-g. samples) are burned in sulphur vapors under vacuum. The metals are converted into sulphides, while oxygen forms sulphur dioxide which is absorbed by water and is then determined colorimetrically with fuchsine-formaldehyde. The sensitivity of the procedure is 10^{-4}%; the duration of the analysis is 5-6 hr. 6 ref. (S11r; Cu, Ni, Cr, Mo, *O*)

218-S. (Russian.) **Determination of Titanium Nitride in Steel.** Yu. A. Klyachko and M. M. Shapiro. *Zavodskaya Laboratoriya*, v. 23, no. 2, 1957, p. 140-143. (CMA)

Unlike the determination of oxide inclusions in steels, the determination of the metal alone in the inclusions is not sufficient in the case of nitride inclusions because, besides the nitride, there may be present carbonitrides and oxynitrides. It is therefore necessary to supplement the determination of the metal by that of nitrogen. The authors find the amount of nitrogen in titanium nitride included in stainless steels by separation; the inclusion in a precipitate remaining after the electrolytic dissolution of the steel sample, dissolving (nitrides and carbides) in potassium bichromate in the phosphoric and sulphuric acids, and distilling off and measuring the liberated nitrogen. (S11f; SS, *Ti*, 14-18)

219-S. (Russian.) **Colorimetric Determination of Molybdenum in Steels by the Extraction Method.** F. G. Zharsvskii and E. F. Gavrilova. *Zavodskaya Laboratoriya*, v. 23, no. 2, 1957, p. 143-146. (CMA)

In studying the possibilities of separating various elements by extraction, the authors found a way to separate molybdenum from tungsten, convenient for analytical purposes. The weakly acid solution of the mixture is treated with phenylhydrazine, whereupon molybdenum forms a red compound that is extracted with an organic solvent, such as isoamyl alcohol, and determined colorimetrically. 6 ref. (S11a; AY, *Mo*)

220-S. (Russian.) **The Problem of the Possibility of Spectral-Analytical Determination of Nitrogen and Oxygen in Titanium.** N. M. Kargan and L. N. Filimonov. *Zavodskaya Laboratoriya*, v. 23, no. 2, 1957, p. 185-187. (CMA)

The authors question the correctness of earlier data which allegedly demonstrated the possibility of a spectral-analytical determination of nitrogen and oxygen in titanium at concentrations not exceeding 1% of the strength on their own results. They deny the possibility of such determination under the experimental conditions adopted, and ascribe the spectral lines observed by earlier investigation to impurities that contaminated their preparations. 2 ref. (S11k; Ti, *O*, *N*)

221-S. Spectrophotometric Determination of Zinc and Other Metals with Alpha-, Beta-, Gamma-, Delta-Tetraphenylporphine. Charles V. Banks and Ramon B. Bisque. *Analytical Chemistry*, v. 29, Apr. 1957, p. 522-528.

Trace amounts of zinc can be determined by utilizing the spectrophotometric properties of the zinc complex of alpha, beta, gamma, delta-tetraphenylporphine in glacial acetic acid. (S11k; Zn)

222-S. Spectrographic Determination of Lead in Leaded Steel. James E. Paterson. *Analytical Chemistry*, v. 29, Apr. 1957, p. 526-527.

Rapid method for the determination of lead in the 0.15 to 0.35% range. Lead can be determined spectrographically by the procedure described in the range from 0.10 to 0.50%. (S11k; ST, *Pb*)

223-S. Flame Spectrophotometric Determination of Copper, Nickel, and Manganese in Aluminum-Base Alloys. John A. Dean and Carl Cain, Jr. *Analytical Chemistry*, v. 29, Apr. 1957, p. 530-532.

Copper, nickel and manganese can be selectively extracted with chloroform as the metal diethyldithiocarbamates from a buffered aqueous solution containing citrate. The elements can then be determined successively by aspirating the chloroform extract into an oxy-acetylene flame. (S11k; Al, Cu, Ni, Mn)

224-S. Colorimetric Determination of Ruthenium. Samuel B. Knight, Ross L. Parks, Sarah C. Leidt and Kenneth L. Parks. *Analytical Chemistry*, v. 29, Apr. 1957, p. 571-574.

A spectrophotometric study of six sulphur-containing compounds which form complexes with the platinum metals. One of the compounds, sigma-diphenylthiourea, has favorable colorimetric properties as a reagent for ruthenium and its stability of color, specificity for ruthenium, and compatibility with the other platinum metals have been studied in detail. 12 ref. (S11a; Ru)

225-S. Detection of Traces of Iron. Fritz Feigl and Alcides Caldas. *Analytical Chemistry*, v. 29, Apr. 1957, p. 580-582.

Soluble or insoluble compounds of trivalent iron give the characteristic red color of bivalent iron when they react with a solution of 2,2'-bipyridine or 1,10-phenanthroline in thiogylcolic acid. 11 ref. (S11; Fe)

226-S. Ferrous Metallurgy. H. F. Beeghly. *Analytical Chemistry*, v. 29, Apr. 1957, p. 638-643.

Developments in the analytical chemistry of ferrous metals and nonmetallic compounds; colorimetry, potentiometry, polarography, mass spectrometry and X-ray analysis. (S11; Fe, ST)

227-S. Nonferrous Metallurgy. M. L. Moss. *Analytical Chemistry*, v. 29, Apr. 1957, p. 670-678.

Review of methods of sampling, preliminary treatment and separations; colorimetry, potentiometry, polarography, fluorimetry and mass spectrometry. 271 ref. (S11; EG-a)

228-S. Detection of Weld Flaws in Chain Links. J. Deakin. *British Safety in Mines, Research Establishment*, Research Report No. 135, Oct. 1956, 31 p.

Purely visual methods of inspection after manufacture or during service are shown to have been in-

adequate in many of the samples investigated. Radiographic, magnetic and electrical, and acoustic methods of nondestructive testing as applied to the various kinds of chain. 9 ref. (S13, T7e)

229-S. The Separation of the Lanthanons With the Aid of Ethylenediaminetetra-Acetic Acid ("Enta Acid"). Pt. VI. Ion-Exchange Studies of the Heavy and Middle Lanthanons and Yttrium. J. K. Marsh. *Chemical Society Journal,* no. 1957, Mar. 1957, p. 978-982. (CMA)

Good yields of purified heavy and middle lanthanons were obtained with a cation exchanger of sulphonated polystyrene and an elutriant of ammonium-buffered EDTA, but separation of dysprosium from yttrium is difficult. The crude is separated into three mixtures and these are re-run to give the pure lanthanons. Procedural details are given. (S11f, EG-g)

230-S. New Spectrophotometric Method for the Determination of Copper With Sodium Versenate. N. A. Ramaiah and Vishnu. *Indian Academy of Sciences, Proceedings,* Section A, v. 45, Feb. 1957, p. 113-116.

A new method employing the absorption at lambda = 630 millimicrons of copper ammonium complex. 19 ref. (S11a; Cu)

231-S. Detection of Chemical Protective Films on Aluminum and Aluminum Alloys. A. J. Raffalovich and F. Firestone. *Metal Finishing,* v. 55, Apr. 1957, p. 65-67.

Stannic chloride reacts rapidly with untreated aluminum. Slower reaction indicates presence of chromate, phosphate for oxide film. (S11; Al, 8-19)

232-S. Method for Fabrication and Inspection of Alloy Steel Piping. Pt. II. Selecting Equipment. Walter W. Offner. *Petroleum Engineer,* Apr. 1957, p. C31-C44.

Application of standards and tests in selecting pipe. (S22; AY, 4-10)

233-S. A Method for the Determination of Radium in Ores and Residues. J. E. Hudgens, R. C. Meyer, C. Zyskowski and L. C. Nelson. New Brunswick Laboratory. *U.S. Atomic Energy Commission,* NBL-128, Mar. 1957, 19 p. $.20.

Samples were packed into 12-ml. glass vials, the vials sealed and the gamma ray activity of the radium detected after a growth period of 30 days. A high-pressure ionization chamber was used as a detector and the gamma rays were filtered through ⅜ in. of lead to minimize the detection of the low-energy part of the radium gamma ray spectrum. 12 ref. (S19c; Ra, RM-n)

234-S. Methods of Separation of Total Rare Earths in Low-Alloy Constructional Steels: a Bibliography. A. Wennerberg. Armour Research Foundation of Illinois Institute of Technology. *U.S. Office of Technical Services,* OTS 57-41, 157 p. $4.

Chemical methods of separation, fractionation and determination. Studies of chemical and physical properties of rare earths and rare-earth compounds. Ion exchange resins, extraction, precipitations, amalgamations, chromatography, ionic migration, colorimetric and conductometric studies, complex formation, solubility studies, spectrographic studies, paramagnetic susceptibility, activation and X-ray studies, and general literature. (S11; AY, EG-g)

235-S. Selective Standardization and Status of Specifications for Titanium Mill Products. Arthur D. Little, Inc. Battelle Memorial Institute, Report 22. *U.S. Office of Technical Services,* PB 124569, Nov. 1955, 23 p. (CMA)

Selective standardization of titanium mill forms comparable to that of aluminum or magnesium awaits further data derived from experience. The aircraft industry is the vanguard of such standardization for titanium. Aeronautical material specifications for titanium are listed. (S22; Ti, 15-22)

236-S. Determination of Niobium and Molybdenum in Uranium Ternary Alloys. G. W. C. Milner, G. A. Barnett and A. Bacon. British Atomic Energy Research Establishment, C/R 1805. *U.S. Office of Technical Services,* PB 119653, 1956, 15 p. (CMA)

Determination of columbium and molybdenum in uranium-base alloys is described. The molybdenum content is determined by a preliminary solvent extraction into hexone with 10 M HF, and 6 M H_2SO_4 and 2.2M NH_4F, followed by extraction into an aqueous phase of H_2O_2, evaporation to fumes of H_2SO_4 and separation into portions for determining columbium and molybdenum. The latter portion has thiocyanate added. The molybdenum thiocyanate complex formed is compared in absorbency with molybdenum standard. (S11f; U, *Cb, Mo*)

237-S. Detection of Internal Defects in a Large Forging Blank by Ultrasound. F. I. Mikhailov. *Henry Brutcher Translation* no. 3863, 5 p. (From *Vestnik Mashinostroeniya,* v. 36, no. 2, 1956, p. 60-64.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 226-S, 1956. (S13)

238-S. Determination of Rare Earths in Steel. H. Krapp. *Henry Brutcher Translation* no. 3864, 3 p. (From *Archiv Eisenhuttenwesen,* v. 27, no. 2, p. 103-105.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 222-S, 1956. (S11, ST, EG-g)

239-S. Spectro-Analysis of Steel for Oxygen. O. B. Fal'kova. *Henry Brutcher Translation* no. 3884, 2 p. (From *Izvestiya Akademii Nauk SSSR,* v. 19, no. 2, 1955, p. 149-150.) Henry Brutcher, Altadena, Calif.

Arrangement and method, based on making the specimen one of the electrodes of a powerful discharge system excited in a hydrogen atmosphere at 270 mm. Hg. Oxygen line used. (S11k, ST, *O*)

240-S. (English.) **Studies on Flame Spectrochemical Analysis. Pt. V. Determination of Manganese.** Shigero Ikeda. *Tohoku University, Science Reports of the Research Institutes,* v. 8A, Dec. 1956, p. 449-456.

Manganese revealed its spectral line at 403.4 millimicrons when it was excited by oxygen-hydrogen flame and its intensity was measured. The intensity of this line was affected by various factors. Alkali metals and alkali earth metals intensified the manganese emission, while aluminum, copper, chromium and nickel weakened it. On the basis of these results the rapid determination of manganese in ferromanganese alloy was proposed. (S11k; *Mn,* AD-n)

241-S. (English.) **Studies Flame Spectrochemical Analysis. Pt. VI. Determination of Strontium.** Shigero Ikeda. *Tohoku University, Science Reports of the Research Institutes,* v. 8A, Dec. 1956, p. 457-462.

Strontium radiated its spectral line at 460.7 millimicrons at very high intensity. The head of the band spectrum of its oxide was at 681 millimicrons. Alkali metal increased the intensity of strontium emissions and the presence of magnesium or appreciably large amounts of calcium caused the depression of its emission, while a large amount of barium enlarged the intensity of emissions. From the results, strontium in shell and limestone was determined rapidly with good reproducibility. (S11k; Sr)

242-S. (German.) **Determination of Small Aluminum Contents in Steel. Pt. II.** Alfred Neuberger and Ernst Schöffmann. *Archiv für das Eisenhüttenwesen,* v. 28, Feb. 1957, p. 65-66.

Reduction of aluminum losses from 25 to 3% by using the enrichment procedure according to A. Zörner, E. Krath and H. Feucht before applying the sodium hydroxide method. Improvement of analysis. 4 ref. (S11; ST, *Al*)

243-S. (Italian.) **Industrial Inspection of Welds by X-Ray and Quantitative Evaluation of Defects Revealed. Porosity Due to Use of Damp Electrodes in Welding of Steel. Pt. III.** Marco Robba. *Ingegneria Meccanica,* v. 5, Nov. 1956, p. 47-51.

Reference radiographs for quantitative evaluation of porosity. Possible lines of study for further research. (Concluded.) 15 ref. (S13e; ST, 7-1, 9-18)

244-S. (Italian.) **Electrolysis at Controlled Potential in the Analysis of the Leading Copper Alloys.** B. Alfonsi. *Metallurgia Italiana,* v. 49, Feb. 1957, p. 89-94.

Theory of electrolysis at controlled potential, necessary equipment, advantages of this technique compared to those of the constant intensity technique. The main applications deal with the analysis of copper alloys. 11 ref. (S11g; Cu)

245-S. (Book—German.) **Light Metal Analysis.** Hans Ginsberg. 285 p. 1955. Walter DeGruyter and Co., Genthiner Strasse 13, Berlin, Germany. DM 24.80.

General discussion of sampling and preparation for chemical and spectro-analysis; dissolving of samples; test methods and instruments. Specific metals discussed are aluminum, beryllium, manganese and titanium. (S11, EG-a, Al, Be, Mn, Ti)

Metal Products and Parts

110-T. The Quantity Production of Motor Car Valves. *Machinery,* v. 90, Mar. 1, 1957, p. 475-483.

Equipment and methods at Austin Motor Co. Ltd., including oxy-acetylene valve stem hardening, valve-end and face grinding operations and automatic application of stellite alloy to seating surface of exhaust valves. (T7b, J2h, G18k, SGA-m)

111-T. Production of the Renault Dauphine. *Machinery,* v. 90, Mar. 15, 1957, p. 564-575.

Techniques and equipment used in casting, cleaning and machining automobile cylinder blocks.
(T21b, E11, L10, L12, G17)

112-T. (French.) **High-Strength Bronzes in the Aircraft Industry.** W. Richardson and L. Feigenbaum. *Métaux-Corrosion-Industries,* v. 32, Feb. 1957, p. 73-78.

Certain special cupro-alloys, impropely called bronzes, are important in aircraft by virtue of their excellent mechanical and physical properties and their resistance to corrosion. Describes the properties and applications of five special alloys: Hidurax I, Hidurax 1/12A, Hidurax 4, Hidurax Special and Hidurel 5.
(T24, Q general, Cu-s, SGA-a)

113-T. (French.) **Zip Fastener Manufacture.** J. Larroque. *Revue de l'Aluminium,* no. 238, Dec. 1956, p. 1155-1159.

Some 62% of all zippers manufactured in France are made of aluminum or aluminum alloys. Fermature Eclair Co. has adopted an aluminum alloy of 5% magnesium (Scleral) with most satisfactory results. Advantages include light weight, corrosion resistance and anodic coloring of the metal to match the color of fabrics.
(T10; Al)

114-T. (French.) **Etalu: a New Combination of Aluminum and Plastic.** Xavier Bechu. *Revue de l'Aluminium,* no. 238, Dec. 1956, p. 1165-1170.

Introduction of proportions of aluminum powder of a suitable granulometry into a wide range of plastics results in an improvement of the mechanical properties, in particular, impart resistance; properties, technology and uses of such plastics (trade name Etalu); results obtained; behavior in die casting.
(T29s; Al)

115-T. (French.) **Aluminum Conductors Insulated by Anodic Oxidation.** J. Patrie and Jean Prieux. *Revue de l'Aluminium,* no. 238, Dec. 1956, p. 1179-1188.

Aluminum wires and strips can be electrically insulated with a nonpeeling, flexible, even and homogeneous aluminum film produced by a continuous process of anodic oxidation. Advantages offered by the aluminum conductor itself and anodic insulation are cited; practical recommendations concerning calculations, control and techniques of winding and joining of conductors; survey of fields of applications, such as generators and electromagnets.
(T1, L19; Al)

116-T. (German.) **Quality Evaluation of Soft Copper Wire for Windings in the Electrical Industry.** O. Lissner. *Metall,* v. 11, Feb. 1957, p. 104-112.

Quality characteristics of copper wire in the electrical industry require high degree of softness and malleability. Influence of trace elements, especially bismuth. 11 ref.
(T1, Q23p, 1-10; Cu, *Bi*)

117-T. The Expanding Use of Aluminum in Railroad Cars. G. B. Hauser. *American Society of Mechanical Engineers, Preprint,* 57-RR-2, Apr. 1957, 5 p.

The versatility of aluminum and a short history of its use in railroad cars. Aluminum alloys currently used, including the aluminum-magnesium series, and their usefulness in welded structures. Tests of such welded structures. New plant facilities covering sheet and plate, extrusions and press forgings. The new process for "flame" cutting aluminum.
(T23p, F general, G general; Al)

118-T. New Heat on Titanium Problems. *Chemical Week,* v. 80, Apr. 13, 1957, p. 27-34. (CMA)

Titanium is still little used by chemical processing firms, but this should change as defense needs are met. Du Pont reports that chemical equipment made of titanium gives better results than test laboratory predictions would indicate. The titanium autoclaves of Calera Mining Co. make continuous cobalt refining operations possible. Cost comparisons are made with stainless steel for several kinds of parts. Experience has shown that titanium may be more easily worked than formerly thought. The scrap problem is discussed. A list of titanium fabricators is appended. (T29; Ti)

119-T. Ceramics Adapt to the Friction Field. *Design Engineering,* v. 3, Apr. 1957, p. 62-64.

New cerametallic friction material, "Cerametalix" is suitable for aircraft brake linings.
(T24b; SGA-m, 6-20)

120-T. Building the Space Satellites. George H. De Groat. *Metalworking Production,* v. 101, Mar. 8, 1957, p. 409-412.

Drawing, spinning, machining and welding operations in production of spherical space satellite from magnesium alloy.
(T24, G general, K general; Mg)

121-T. Progress Report on Ceramics—Pt. 5. Russians Put Emphasis on Ceramics. Peter Trippe. *Metalworking Production,* v. 101, Mar. 15, 1957, p. 443-447.

Report on ceramic tooling development in Russia; technique used in metallizing of ceramic tips in preparation for brazing to tool shank.
(T6n, SGA-j, 6-20)

122-T. P and WA Makes J57 Compressor of Titanium. W. H. Sharp. *SAE Journal,* v. 65, no. 5, Apr. 1957, p. 17-19. (CMA)

The J57 turbojet engine of Pratt and Whitney Aircraft Division, United Aircraft, is being produced with blading of Ti-6Al-4V. Advantages are low density and good high-temperature strength. The alloy is also used for disks and disk spacers. A-110AT is valuable for welded stationary uses (compressor cases, etc.) which are subject only to moderate stress. C-130AM and other titanium alloys have previously been used in jet engines. (T7h; Ti)

123-T. High Temperatures Cause Muffler Failure—but Coated Steels Give Promise of Longer Life. W. Chow, G. E. Nelson, P. S. Meyers and P. C. Rosanthal. *SAE Journal,* v. 65, Apr. 1957, p. 78-79.

Temperatures encountered by mufflers on over-the-road trucks were determined. Laboratory tests on various muffler materials were then made. (T21; ST, 8)

124-T. 16-15-6 Alloy Fills a Need. Martin Fleischmann. *Steel,* v. 140, Mar. 25, 1957, p. 102-105.

Possible applications of chromium-nickel-molybdenum steel alloy. Effect of tempering time, tempering temperature and quenching temperature on strength and hardness values.
(T general, Q general; SS, SGA-h)

125-T. (Italian.) **Ceramic Tools and the New Carbides.** O. G. *Macchine,* v. 12, 1957, p. 89-95.

Sequel to a previous article on the use of ceramic materials in cutting tools; proposes to clear up debated points and furnish further data on these new products.
(T6n; 6-20)

126-T. (Portuguese.) **Production and Quality of Rolled Steel for the Brazilian Automotive Industry.** Pedro Silva. *Engenharia, Mineracao e Metalurgia,* v. 25, Jan. 1957, p. 9-16.

New government program for development of automotive industry envisages 90% domestic production of truck-type requirements by July 1960, up from 40% at end of December 1956. Survey of Volta Redonda mill for supplying increasing demand, present standards, future improvements, details on properties of sheet currently being rolled.
(T21, F23)

127-T. Titanium Displaces Steel in J57 Engine. I. Stone. *Aviation Week,* v. 66, Apr. 8, 1957, p. 67, 69, 72. (CMA)

The J57 turbojet engine of Pratt and Whitney uses a compressor of Ti-6Al-4V because of the weight and corrosion problem with steel. Also, numerous engines with rotor parts of various titanium alloys have been built. The best alloy for welded stationary uses is A-110AT. Ti-6Al-4V is lighter than Ti-140A, Ti-150A and C-130AM and is currently specified for blades, disks and disk spacers. (T24b; Ti)

128-T. Role of Special Nickel-Based Alloys in the Chemical Industry. *Chemical and Process Engineering,* v. 38, Mar. 1957, p. 95-97.

The problem of choosing suitable metals for particular applications where corrosive chemicals are involved; useful summary of the properties and applications of a series of special nickel-based alloys.
(T29; Ni)

129-T. Unpainted Light-Alloy Superstructure. *Marine Engineer,* v. 80, Apr. 1957, p. 134-136.

Throughout 2½-year life, the aluminum alloy superstructure of the steamship "Sunripe" has remained unpainted. Brief description of the ship, her purpose and the performance of the alloy.
(T22g; Al)

130-T. Structural Steels for Warship Building With Some Notes on Brittle Fracture. Victor Shepheard. *North-East Coast Institution of Engineers and Shipbuilders,* Preprint, Mar. 1957, p. 301-330.

Scientific and technical developments are revolutionizing weapons, equipment and the warship hulls which carry them into service. Of the many problems which these changes are bringing to warship design, two particular aspects, namely developments in hull structural design and structural steels, are dealt with. (T22g, Q26s; ST, SGB-s)

131-T. Use of Protective Liners in Kraft Digesters. J. A. Adam, D. E. Covey and C. H. Rimmer. *Paper Trade Journal,* Apr. 29, 1957, p. 22-28.

Three main physical variables involved in scale formation in Kraft digesters are thermal shock, circulation rate, and alkali concentration versus temperature. Mild steel and studded liners are evaluated.
(T29r, R6j; CN)

132-T. Bearings for Tough Jobs—Difficult Environments, High Temperatures, Nuclear Reactors. *Steel,* v. 140, Apr. 8, 1957, p. 114-118.

Rates ball, ring, separator and sealing materials for ball bearings according to ability to withstand extremes of heat, lack of lubrication, oxidizing conditions, magnetism and use in nuclear reactors. (T7d, T10; SGA-h)

133-T. (English.) **Production of Steels for Ball Bearings.** *Aciers Fins & Speciaux,* no. 25, Mar. 1957, p. 91-92.

Analysis of the factors governing the quality of a ball bearing steel and which in turn determine homogeneity, purity and machinability. (T7d, D general, G17k; ST)

134-T. (French and German.) **Aluminum in Chemical Apparatus.** E. Moor. *Aluminium Suisse,* v. 7, Mar. 1957, p. 43-56.

Manner in which aluminum and aluminum alloys are used as materials in the chemical industry; properties of aluminum and comparison with other metals; resistance to corrosion; construction problems and design problems of aluminum; analysis of mechanical characteristics. (To be continued.) (T29; Al)

135-T. (German.) **Aluminum for Architectural and Construction Purposes.** M. Gottschalk. *Metall,* v. 11, Mar. 1957, p. 202-208.

Aluminum alloys in architecture for outside and inside applications; some alloys can be applied for construction in halls, tents, bridges, buildings, cranes and greenhouses. Description of alloys for special purposes. (T26; Al)

136-T. (Italian.) **Guide to Selection of Steels for Refineries as Related to Use Temperatures.** Giuseppe Pastonesi. *Calore,* v. 27, Dec. 1956, p. 571-576.

Steels recommended for use in four temperature categories: medium (5-300° C.); high (300-600° C.); very high (above 600° C.); low (under 5° C.). Reasons for these divisions. 14 ref. (T29; SGA-h)

137-T. (Italian.) **Nickel as a Catalyst.** *Il Nickel,* no. 66, Feb. 1957, p. 1-6.

Preface to a series of articles on specific applications of nickel catalysts. Catalytic phenomena and chemical reactions; base materials used in preparation of nickel catalysts; Raney nickel catalysts. (T29; Ni, NM-c)

Plant Equipment

146-W. Applications of the Shaker-Hearth Furnace. Heat Treatment on a Quantity Production. *Australasian Manufacturer,* v. 41, Feb. 9, 1957, p. 43-45, 57.

Shaker-hearth furnaces have virtually eliminated the problems hitherto inherent in the heat treatment of small parts in large quantities. Since the design was introduced, between 80 and 90 units have been installed. With standard hearth widths from 6 to 24 in., the furnaces are proving suitable for hardening, and in some instances tempering and austempering, a wide range of small carbon steel components. (W27)

147-W. Liquid Metals and Nuclear Power. C. D. Boadle. *Atomics and Nuclear Energy,* v. 8, Mar. 1957, p. 83-85, 106.

Use of liquid metals as a means of high-temperature heat extraction from nuclear reactors. Liquid metals have particular advantages as a heat transfer medium over other substances, but their disadvantages are that they require, amongst other things, a complex primary cooling circuit. (W11, 17-7; 14-10)

148-W. Complete Mechanization of Heat Treating—a Growing Trend. O. E. Cullen. *Flow,* Jan. 1957, p. 55-58.

Mechanized heat treating equipment is effectively pointing the way to automation in the heat treat shop; processes and equipment are described. (W27, 18-24)

149-W. Titanium Sponge Handling System. J. Grindrod. *Mining Journal,* v. 248, Mar. 15, 1957, p. 336. (CMA)

A system of bulk handling of titanium sponge was developed by Tote Systems, Inc., for Rem-Cru. Hermetically sealed aluminum bins are employed for the transport and storage of sponge. The use of 60 bins has resulted in a saving of $25,000. (W12; Ti, 6-24)

150-W. Production Machines for Coated Abrasives. *Precision Metal Molding,* v. 15, Mar. 1957, p. 68-71.

Survey of some of the newer machines, both portable and stationary, that have been developed to use coated abrasives. (W25, NM-j)

151-W. (French.) **New Results of Tests on Ingot Molds.** G. Bauer, J. Duflot and A. Gibeau. *Fonderie,* no. 133, Feb. 1957, p. 64-79.

Design, preparation and use of ingot molds; analysis of the relationship between the weight of the ingot mold and the weight of the ingot. 6 ref. (W19, 17-1)

152-W. (French.) **Electrochemistry and Electrometallurgy at the Service of Atomic Energy.** *Journal du Four Eléctrique,* no. 6, Nov-Dec. 1956, p. 195-197.

Atomic reactors; use of heavy metals (uranium, thorium), light metals such as cadmium and magnesium, metalloids (graphite) in the construction of nuclear piles; shows the close interdependence between the electrochemical and electrometallurgical industries and atomic industry. (W11, 17-7, 1)

153-W. (French.) **Continuous Furnaces for the Annealing of Tubes.** *Pratique des Industries Mécaniques,* v. 40, Jan. 1957, p. 24-26.

Types of continuous furnaces; construction and mode of operation; fuels employed. (W27, 1-11, J23; 4-10)

154-W. (French and German.) **Use of the Heating Torch in Industry.** Jacques Delambre. *Journal de la Soudure,* v. 47, no. 3, Mar. 1957, p. 75-81.

Uses in stamping, forming and forging operations. (W29, F21b)

155-W. (German.) **Steel for High-Pressure Die-Casting Dies and Molds.** H. Hiller. *Giesserei,* v. 44, Mar. 14, 1957, p. 141-149.

General remarks on hot working toolsteels; effect of the alloying elements; thermal shock stress of the die steels; steels for high-pressure die-casting dies and molds; susceptibility of the die steels to hot cracking; degree of deformation and orientation of the structure; forging of single dies; heat treatment; nitriding; strength of the die steels in service. (W19, 17-7, E13; TS-k)

156-W. (German.) **Modern Special Furnaces for the Continuous Annealing of Strip Brass.** F. Deutz and R. Jansen. *Metall,* v. 11, Feb. 1957, p. 120-123.

Determining factor for the choice between gas or electrically heated furnaces is the price of gas or electricity. Description of two roller furnaces, one with gas revolution and cooling by water shower, the other with direct gas heating and cooling by means of a protective gas. (W27, J23, 1-11; Cu-n, 4-3)

157-W. (Italian.) **Modernization of a Continuous Rod Mill.** Baldo Nozza. *Atti Notizie* (Monthly Bulletin of Italian Metallurgical Assoc.), Incorporated in *Metallurgia Italiana,* v. 11, Dec. 1956, p. 413-416.

Postwar changes and addition to Unione Works of Falck Co., Milan, made gradually (and still incomplete) without extended interruption of production. (W23, 18-20)

158-W. (Russian.) **Machine for the Fast Charging of Martin Furnaces.** A. V. Kolesnikov. *Vestnik Mashinostroeniia,* v. 37, no. 1, Jan. 1957, p. 19-22.

Description of machine requiring neither remodeling of the furnace nor installation of new carriage facilities in plants with crane charging; prevention of significant heat loss during charging of scrap, ore, limestone, etc. 4 ref. (W18, W12)

159-W. (Russian.) **Blast-Furnace Slag Bucket With New Type of Ribbing.** K. A. Pak. *Vestnik Mashinostroeniia,* v. 37, no. 1, Jan. 1957, p. 23-25.

Effects of temperature, fracture and deformation near the bearing races upon strength of the slag bucket. New methods of ribbing to combat deformation. (W12, W17)

160-W. Heat and Pressure Resistant Alloys for Gas Turbines and Nuclear Reactors as Power Plants. M. S. Thacker. *Indian Institute of Metals, Transactions,* v. 8, 1954-55, p. 37-59.

Composition of high-temperature alloys, special requirements of nuclear power plants, neutron adsorption capacity, special metals and cermets. (W11, 17-7; SGA-h)

161-W. Some Experiments on the Substitution of Low-Carbon Ferromanganese in Flux of Coated Arc Welding Electrodes by High-Manganese Core Wire. D. R. Dhanbhoora, S. Visvanathan and S. N. Anant Narayan. *Indian Institute of Metals, Transactions,* v. 8, 1954-55, p. 301-308.

Low-carbon ferromanganese is a standard constituent in electrode fluxes. Use of high-manganese core wires in place of the standard rods. The development of a suitable flux coating for such rods is traced. 7 ref. (W29; Mn, RM-q)

162-W. Titanium Work Holders Speed Anodizing Process. G. C. Close. *Light Metal Age,* v. 15, Feb. 1957, p. 37. (CMA)

A titanium-tipped aluminum rack for chromic acid anodizing was designed for the Torrance plant of Douglas Aircraft. Time and money are saved. A trial run of all-titanium racks in the chromic acid electrolyte gave poor results; much current was lost to the solution. Racks with titanium work holders riveted in place behaved similarly. (W3, 17-7; Ti)

163-W. Production of Air Cleaner Shells on a Transfer Press. W. N. Hanna. *Machinery,* v. 90, Mar. 22, 1957, p. 637-640.

Description of press and transfer equipment used in successive blanking, drawing, piercing, and trimming operations in production of base for air cleaner from steel strip. (W24)

164-W. (German.) **Applicability of the Short Rotary Furnace in Nonferrous Metallurgy.** Edwin Neubert. *Neue Hütte,* v. 1, Jan. 1957, p. 39-43.

Melting tests; intermediate product treatment; transfer of know-how gained from small-scale experiments to short rotary furnace design; commercial considerations. (W18; EG-a)

165-W. (Italian.) **In-Plant Transport in the Steel Industry.** Nicola Marangoni. *Fonderia,* v. 6, Feb. 1957, p. 71-79.

Methods used at Soc. Nazionale Cogne (Aosta, Italy) and flow of material in production of low and alloy steels. (W10, D general; AY)

166-W. Zirconium as a Reactor Material. F. R. Paulsen. *Atomics,* v. 8, no. 4, Apr. 1957, p. 121-123. (CMA)

Occurrence, extraction and purification of zirconium. Aside from its value as a corrosion resistant material in the chemical process industries, zirconium has great value as a material in nuclear reactors because of its core life and neutron economy. The use of zirconium for cans in the moderator of the Nautilus is described; getters in the form of alloying additions were necessary to keep oxygen contamination from liquid sodium low. Mechanical properties and corrosion resistance are adversely affected by intense radiation which disturbs the crystal lattice. A modified heliarc method makes possible butt welds 10 ft. long. (W11, 17-7, 2-17; Zr)

167-W. Thread Grinding Wheel Selection. D. H. Curry. *Automatic Machining,* v. 18, Apr. 1957, p. 54-58.

Conditions affecting selection of grain and bond for grinding wheels were type and pitch of thread, material, production rate, finish, equipment, dressing practice and grinding fluid. (W25)

168-W. ISCOR's Manufacture of Welding Wire. Processes From the Ore to the Finished Wire. M. Eaton. *Engineer and Foundryman,* v. 21, Mar. 1957, p. 50-55.

Iron ore used at Pretoria is a dense hematite, low in phosphorus and free from sulphur; method of refining the ore and the mechanical properties of the wire produced. (W29, 17-7, D general, Q general; ST)

169-W. Rating System Simplifies Welding Electrode Selection. O. T. Barnett. *Iron Age,* v. 179, Apr. 4, 1957, p. 91-96.

Rating factors on deposition rate, penetration, ductility, soundness, freedom from splatter, weld positions and classifications of nine commonly used mild steel electrodes. (W29, 15; CN)

170-W. Forged Steel Cogging-Mill Rolls. Prevention of Breakage. M. Massin. *Iron and Coal Trades Review,* v. 174, Apr. 12, 1957, p. 863-865.

Forged and cast steel rolls compared and roll compositions evaluated. (W23, 17-7; ST, 4-1, 5)

171-W. How to Select the Proper Heat Treating Equipment. Carl F. Burling. *Metal Treating,* v. 8, Mar-Apr. 1957, p. 2-4, 21, 29, 38 and 39.

Emphasizes consideration of plant conditions and requirements; types of furnaces available. (W27)

172-W. Uranium's Future in the Energy Field. Chauncey Starr. *Mining Congress Journal,* v. 43, Apr. 1957, p. 118-120.

The physical process of atomic power generation, the "workings" of different types of reactors. Focuses attention on developments that will lead to the rapid growth in uranium requirements. (W11, 17-7; U)

173-W. Everlasting Anodizing Racks. K. Darby. *Modern Metals,* v. 13, Apr. 1957, p. 78, 80, 82. (CMA)

Evidence supports titanium as the optimum material for anodizing racks, but specifically designed titanium racks are prohibitive in cost. A universal titanium rack has been designed by Robé Inc., Springfield, Va., which has as a basic element a T-slot channel. Several variations are described: the Bi-Var (two channels spot-welded back to back), the Tri-Var (three channels), the Multi-Var and the Verti-Var. Commercial titanium is the material used since alloys do not carry enough current and are less acid resistant. (W3, 17-7; Ti)

174-W. Welding Electrode Selector. *Steel,* v. 140, Apr. 1, 1957, p. 98 + 6 p.

Tables giving trade names and ASTM-AWS specification numbers of electrodes of mild steel, low-alloy steel, stainless, automatic wire, aluminum, magnesium and copper. (W29, 17-7, 15-18; CN, AY, SS, Al, Mg, Cu)

175-W. New Developments in the Welding of Heavy-Gage Steel Plate. M. M. Fishkis. *Henry Brutcher Translation* no. 3774, 5 p. (From *Avtomaticheskaya Svarka,* v. 8, no. 5, 1955, p. 74-77.) Henry Brutcher, Altadena, Calif.

Description of a new high-efficiency coil semi-automatic welding gun; examples of its use for welding press crossheads, refacing worn parts and repairing defects in steel castings. (W29)

176-W. Use of High-Alumina Brick in Hot-Blast Stoves. A. I. Kulik, et al. *Henry Brutcher Translation* no. 3367, 4 p. (From *Stal',* v. 16, no. 7, 1956, p. 582-585.) Henry Brutcher, Altadena, Calif.

Plant-scale trials on performance of high-alumina brick, fired and green, respectively, in domes and upper checker courses of hot-blast stoves of blast furnaces on basic iron and on ferromanganese. (W17; Fe, RM-h)

177-W. (French.) **English Built Foundry Machinery.** *Metallurgie et la Construction Mecanique,* v. 89, Mar. 1957, p. 233-234.

Molding machines; furnaces and cupolas; sand equipment. (W19, W18)

178-W. (French.) **Evolution of the Technology of Industrial Furnaces.** J. G. Robin. *Metallurgie et la Construction Mecanique,* v. 89, Mar. 1957, p. 253-255.

Development of mechanization; special furnaces, construction details, water cooling, gaseous atmospheres; recent installations in France and Europe. (W27, W18)

179-W. (French.) **Material Handling Apparatus in the Iron and Steel Industry.** *Metallurgie et la Construction Mecanique,* v. 89, Mar. 1957, p. 259-263.

Equipment used in crushing and agglomerating; surveys coke plants, blast furnaces, steelworks and rolling mills. (W12; ST)

180-W. (French and German.) **Standardized Aluminum Sections for the Construction of Air Ducts.** Hans Badertscher. *Aluminium Suisse,* v. 7, Mar. 1957, p. 71-72.

Details of assembly using seven standardized aluminum joints; applications include use in equipment for air conditioning and heating in humid or acidic atmospheres; advantages over rigid sections. (W10, 17-7; Al)

181-W. (German.) **Pneumatic Lifting Apparatus Used in the Foundry.** W. Gesell and W. Riege. *Giesserei,* v. 44, Mar. 28, 1957, p. 179-182.

Peculiarities of the electric hoist and of pneumatic lifting apparatus; range of application; layout for cost accounting. (W12, E general)

182-W. (German.) **Automation of Cupola Furnace Charging.** H. Gluge. *Giesserei-Praxis,* v. 75, Feb. 10, 1957, p. 57-59.

Installation and advantages of automatic overhead hoisting mechanisms. (W18, W12, 18-24)

183-W. (German.) **Electric Resistance Heating for the Processing of Steel.** Wilhelm Stich. *Stahl und Eisen,* v. 77, Apr. 4, 1957, p. 394-408.

Mode of action and design of the heating apparatus; heating process and scaling; current consumption and economy. Quality of the surface, grain size and dissolution of the structure of heat treated steel. (W27, J general)

184-W. (German.) **Volklingen-Type Cross-Flow Shaft Kiln for Burning Small Lump Limestone.** Werner Heiligenstaedt. *Stahl und Eisen,* v. 77, Apr. 4, 1957, p. 421-426.

Selection of a new lime burning kiln; its firing and flow principles; description of the kiln as built; operational results; experience with a basic converter steel plant using lime in small lumps; improved design resulting from the knowledge gained from trial operation. (W13; NM-e)

185-W. (German.) **Crucible Induction Furnace for Nonferrous Heavy Metal Alloys.** Dieter Hartman and Heinz Rohn. *Zeitschrift für Metallkunde,* v. 48, Mar. 1957, p. 85-90.

Development of an 800-kg. capacity, 50-cps. furnace for copper-rich alloys; its efficiency is compared with a ring-shaped induction furnace. 6 ref. (W18; Cu)

186-W. (German.) **Crucible Furnaces.** Hans H. Pistor. *Zeitschrift für Metallkunde,* v. 48, Mar. 1957, p. 101-103.

A survey of crucible furnaces (except induction furnaces) for light and heavy metals. Gas and oil-fired furnaces permit adjustment for a slightly reducing atmosphere. Regulation of temperature is possible for each mode of heating. (W18; RM-k, RM-m)

187-W. (Italian.) **Rotary and Spirek Furnaces in Mercury Metallurgy.** Agostino Busachi. *Industria Mineraria,* v. 8, Jan. 1957, p. 15-16.

Recent initial installation of rotary furnaces (Gould) in Italy leads author to consider relative merits of two above types as regards production, operating costs, health factors. (W18; Hg)

188-W. (Italian.) **Abrasive Tools and Factors Determining Their Efficiency.** Gualtiero Pizzetti. *Rivista di Meccanica,* no. 151, Dec. 15, 1956, p. 9-15.

Rigid and flexible types; uses; wet working; characteristics and properties of abrasive raw materials. 9 ref. (W25; NM-j)

189-W. (Book—German.) **Handbook of Technical Electro Chemistry, v. 4, Pt. 3A. Electric Furnaces.** Georg Eger, ed. 323 p. 1956. Akademische Verlagsgesellschaft Geeste & Porting K. G. Sternwartenstrasse 8, Leipzig, C 1, Germany. DM 36.

Compliation of articles on the use of electrical furnaces for copper, nickel, cobalt, lead, zinc, aluminum and manganese. (W18, C21d; Cu, Ni, Co, Pb, Zn, Al, Mn)

Instrumentation

Laboratory and Control Equipment

37-X. New Drawing Die Measuring Microscope. A. Metz. *Draht (English Edition)*, no. 27, Feb. 1957, p. 16-17.

Leica microscope for measuring diameter and length of parallel bore and angle of entrance cone of die for wire drawing. (X3, F28)

38-X. Russian Survey. Pt. 10. Gauge and Toolmaking in the Soviet. Peter Trippe. *Metalworking Production*, v. 101, Mar. 1, 1957, p. 355-363.

Description of Russian factories producing measuring tools, gages and optical instruments. (X20, X3)

39-X. Solving Weight and Production Problems With Mg. Robert E. Short. *Modern Castings*, v. 31, Mar. 1957, p. 53-54.

Magnesium's light weight, machinability, and its casting and drawing qualities have made possible a rugged 48-lb. military teleprinter. (X15, 17-7; Mg, 17-2)

40-X. Furnace Atmosphere Analyzers. Wayne L. Besselman. *Metal Progress*, v. 71, Apr. 1957, p. 97-103.

Rugged and precise equipment is now available for continuous measurement, recording and control of dew point, content of specific gases, total combustibles, and specific gravity of prepared furnace atmospheres. (X7, X22, J2k, 1-2)

41-X. Control of Atmosphere Converters. Walter H. Holcroft. *Metal Progress*, v. 71, Apr. 1957, p. 104-108.

Atmosphere generators are economically controlled by proportioning the relative volumes of air and fuel gas pumped into them. Exothermic generators may be simply regulated by temperature or by the combustibles in the gas. Endothermic generators are best operated at constant output, wasting any temporary excess of gas, and controlling either water or carbon dioxide content of the atmosphere. (X7, J2k, 1-2)

42-X. Controlling Atmospheres in Furnaces. Orville E. Cullen. *Metal Progress*, v. 71, Apr. 1957, p. 109-114.

Normal operating variables in atmospheres within the furnace can usually be ironed out by instrumentation controlling dew point according to time schedule (in batch-type furnaces) and by individual instruments at two or three zones controlling dew point (in continuous carburizing furnaces). (X7, J2k, 1-2)

43-X. Stress Relieving Simplified With Multipoint Temperature Recorder. Ralph M. Stotenburg. *Metal Treating*, v. 8, Mar-Apr. 1957, p. 18-20.

Twenty-four point recorder controller used with thermocouples in stress-relieving furnace permits close control and maintenance of uniform temperatures in different sections of part. (X9, J1a)

IF YOU ARE AN ENGINEER . . .

. . . interested in entering the field of technical writing and editing, the American Society for Metals is interested in hearing from you.

Attractive positions are now available to engineers who have a special knowledge of metals . . . or any phase of their processing, fabrication, application or design. If you have confidence in your ability to write, you may qualify for a position in one of the following departments:

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A.S.M. Handbook

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H. M. McCord

American Society for Metals

7301 Euclid Avenue **Cleveland 3, Ohio**

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The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.

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TEACHING: Privately endowed eastern college offering engineering and liberal arts degrees, is expanding metallurgical engineering department. Rank and salary open. Teaching ability in any metallurgical field can be used. Reasonable teaching load. Position open Sept. 1, 1957. Location of school and facilities attractive for man to engage in consulting and research. Graduate studies offered at nearby locations. Box 6-5.

METALLURGIST: To work in metallurgy section of central research laboratory of nationally known company. Experience in precious metals and glass-to-metal seals desirable but not necessary. Prefer young man with B.S. degree in metallurgy or chemical engineering. Send resume and salary requirement; replies held confidential. Box 6-10.

MATERIALS ENGINEER: Immediate opening for graduate metallurgist with experience in the application of light alloys to act as consultant to design engineers and process engineers. Applicants should have knowledge of commercial and government specifications. Experience or ability in the preparation of specifications and engineering information on properties and characteristics of materials is desired. Send resume of education, experience and salary requirements. Box 6-15.

DIRECTOR OF APPLICATION ENGINEERING: To direct a staff providing guidance to sales division of large primary nonferrous metal producer on all technical aspects of industrial and consumer uses of aluminum. Assist in developing new aluminum products and improving present ones. Act as clearing center on technical information between sales and production. Supervise research regarding field testing of products; investigate and make recommendations for correction of customer complaints. Must know aluminum and its characteristics and have a good understanding of its production, fabricating, machining, forming, etc. Must be sales and profit minded. Must have the personality to work well with sales executives and important customers. Should be a good supervisor. Degree in engineering, metallurgical preferred; Ph.D. ideal but not essential. Age 35-55. Compensation from $20,000 to $30,000. New York City. Box 6-115.

Midwest

PHYSICAL METALLURGIST: Excellent opportunity immediately available for graduate with B.S. or M.S. degree with approximately five years experience. Position will include studies of equipment failure and research on corrosion resistance and quality control. Will also supervise and correlate operation of testing laboratory. Opening is at St. Louis headquarters. Send resume to: Director of Personnel, Research and Engineering Division, Monsanto Chemical Co., Box 8, Station B, Dayton 7, Ohio.

METALLURGIST: With Met.E., or Ch.E. degree, to assume supervision of metallurgical laboratory in a modern plant of a nationally known metal fastenings manufacturer located in suburb west of Chicago. Position is well balanced in administrative, supervisory and technical aspects. Experience in electroplating and heat treating desirable. Please furnish details of education, experience and salary requirements. Box 6-20.

SALES ENGINEER: Opportunity for sales inclined engineer, 25-35, to associate himself with established manufacturers' agent in Cleveland handling products for materials handling, heat treating, corrosion resistance and processing. Must be Cleveland resident, to cover Northwestern Ohio, requires limited travel. Commission arrangement with expenses reimbursed and income guaranteed for first year. Send resume. Box 6-120.

ASSISTANT PROFESSOR: In physical metallurgy, nine months appointment, salary dependent on experience and academic background. Write: Dept. of Metallurgical Engineering, Missouri School of Mines and Metallurgy, Rolla, Mo.

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ASSISTANT PROFESSOR: Challenging position at southwestern university on staff of growing school of metallurgical engineering for Ph.D. in metallurgy, physical chemistry, chemical engineering or solid state science. Nine month salary of $6000 with excellent opportunities for salary augmentation by sponsored research and consulting. Position available about Sept. 10, 1957. Box 6-25.

West

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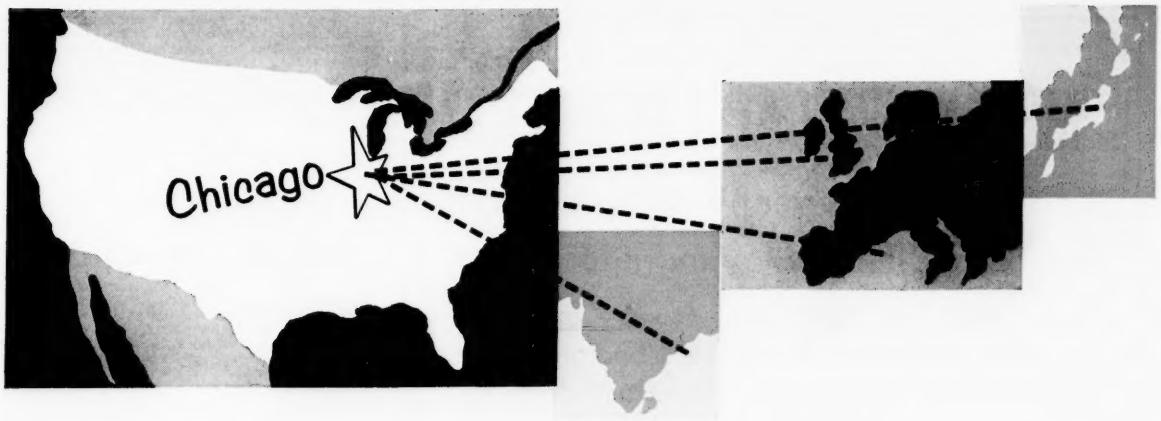

39th National Metal Exposition
2nd World Metallurgical Congress

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From wherever metals are made . . . from wherever metals are used . . . from all parts of the United States and around the free world, the responsible men of metals will move into Chicago the week of November 4, 1957.

Engineers and scientists . . . executives and production experts . . . the responsible men of metals will be in Chicago to see the 39th National Metal Exposition — the best, the biggest, the most important Metal Show of them all. Hundreds of manufacturers will place their best products and operating processes and equipment on display in the vast International Amphitheatre and New Exposition Halls. This great Exposition will make show history . . . will make metals history.

And this is only half the story. World authorities on metals . . . outstanding scientists from the United States . . . again, the responsible men of metals will be speakers at the 2nd World Metallurgical Congress and at the 39th National Metal Congress. Technical and practical sessions will begin on Saturday, November 2, and run continuously through Friday, November 8. Never before has such an array of metals engineering and scientific talent been assembled on so vast a scale . . . engineering developments of world-wide impact will be presented for all to hear and digest and discuss.

You will want to attend this great event, this world metals week in Chicago. Your organization may well wish to send management, engineering and sales representatives. Make the first move now — write for hotel reservation forms.

AMERICAN SOCIETY FOR METALS

The Engineering Society for the Metal Industry

7301 Euclid Avenue — Cleveland 3, Ohio

Cooperating Societies: Metals Division, American Institute of Mining, Metallurgical and Petroleum Engineers . . . the Society for Non Destructive Testing . . . the Industrial Heating Equipment Association.

Exhibit Space Available

Hundreds of manufacturers have reserved Metal Show space, but there are good locations still available in the vast new exposition halls of the International Amphitheatre. If the metalproducing or metalworking industries are your market, don't miss this show — write for display information now.

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Key positions currently available with established ferro-alloy manufacturer:

Gray Iron Metallurgist—foundry experience and strong metallurgical background desirable. Duties include field and development service work, requiring moderate travel.

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Salaries commensurate with qualifications. Liberal benefits. Advancement opportunity. Relocation paid. Write in confidence to:

Box 6-95, Metals Review

perience in heat treating, forming, design consultation, technical writing, properties evaluation, flash welding, spot/seam welding, fusion welding, brazing, tension testing, fatigue testing, creep testing, design and fabrication of test equipment, strain gages, failure analysis, aluminum alloys, stainless steels, low alloy steels, ultra-high-strength steels, high-temperature alloys, titanium alloys. Location in smog-free El Segundo, Calif., where it is warm in winter and cool in summer, adjacent to the Los Angeles airport. Send resume to: P. B. White, B-140, Douglas Aircraft Co., Inc., El Segundo, Calif.

METALLURGY TEACHER: For undergraduate and graduate courses in one or more of the following fields: Process metallurgy, physical metallurgy, X-ray metallography, metallurgical thermodynamics, kinetics. Recent Ph.D. preferred but will consider M.S. in metallurgical or chemical engineering. Rank and salary depend upon qualifications. Send resume of education, experience and teaching philosophy. Box 6-30.

METALLURGIST: B.S. degree and two to five years experience in metal fabricating, heat treating, welding and brazing. Work will be in methods development for rockets and guided missiles. Location in southern California desert community, population 12,000, 150 miles from Los Angeles. Ideal living and working conditions. Box 6-100.

WELDING ENGINEER: B.S. and two to five years experience in welding and brazing. Good basic knowledge of metallurgy required. Work is in methods development for rockets and guided missiles. Location in southern California desert community, population 12,000, 150 miles from Los Angeles. Ideal living and working conditions. Box 6-105.

PHYSICAL METALLURGIST: Grade GS-1321-7, annual salary $5335. Interested applicants should contact the Civilian Personnel Office, Holloman Air Force Base, New Mexico.

PHYSICAL METALLURGISTS: Opportunities for two metallurgists at Naval Air Station, Corpus Christi, Tex., Grade GS-9, $5845 per year, and Grade GS-11, $7035 per year, starting salaries. Interesting work in aircraft materials and process control, research, investigation of material failures and process development, in support of Naval industrial activity. Well-equipped laboratory, excellent working conditions, Federal employment benefits. In addition to academic training in metallurgy, applicants must show 1½ to 2½ years of specialized experience in physical metallurgy. Send inquiries to: J. S. Kusiv, Materials Engineering Superintendent, Overhaul and Repair Dept., U.S. Naval Air Station, Corpus Christi, Tex. Forwarding of civil service Standard Form 57 will expedite determination of eligibility. Information on living conditions in this community will be furnished interested applicants.

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Process development program at J&L offers exceptional opportunities to man interested in applying engineering fundamentals and physical chemical data to process design. The program involves modifications in conventional steelmaking practices and development of new processes for production of carbon and alloy steels as well as production of other related metals. There are many challenging problems both on an engineering scale and in the research laboratory.

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JONES & LAUGHLIN STEEL CORPORATION

3 Gateway Center
Pittsburgh 30, Pa.

POSITIONS WANTED

METALLURGIST: B.S. degree, age 33. Nine years experience in melting and casting (both air and vacuum), forging, rolling and physical testing. Experienced with carbon and alloy steel, stainless steel, nickel and cobalt-base high-temperature alloys and titanium. Desires position in development or production. Box 6-35.

METALLURGIST: B. of Ch.Engr. degree. Seventeen years diversified experience includes 5½ years in nonferrous foundry field, 8 years in material and process laboratory as related to light manufacturing (6 years as laboratory supervisor), 2 years electroplating and anodizing. Production trouble shooting in all fields. Desires position of responsibility such as chief metallurgist or director of laboratory. Minimum salary $8500. Box 6-40.

PATENT ATTORNEY: B.S. in Met.E., LL.B., age 26, married, one child. Five years industrial experience in metallurgy, electroplating research, production and control. Acquired law degree in evening school. Desires to enter patent field. Will take state bar exam in fall and be available immediately thereafter. No preference as to location. Box 6-45.

SUPERVISING METALLURGIST: Experience ranging from cast irons to high-temperature alloys and fissionable materials. Four years supervising and directing metallurgical research and development. Two years prior experience engineering pilot plant and production start-up. M.S. degree, 32, family. Desires position which utilizes experience and fosters further development of management abilities. Box 6-50.

METALLURGIST: B.S. degree in metallurgy (M.I.T.), single, age 26. Desires position in metallurgical development or production. Four years experience in metallurgical development and control laboratory. Will relocate. Box 6-55.

PRODUCTION EXECUTIVE: Age 41, married. Extensive background in metal industry, including manufacturing management, plant engineering, layout, process, methods. Knowledge of ferrous metallurgy, budget control, distortion control in gear manufacturing

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RULES FOR ENTRANTS

Exhibitors do not need to be members of the American Society for Metals.

Work which has appeared in previous metallographic exhibits held by the American Society for Metals is unacceptable.

Photographic prints should be mounted on stiff cardboard, maximum dimensions 14 by 18 in. (35 by 45 cm.). Heavy, solid frames are unacceptable.

Entries should carry a label on the *face* of the mount giving:

Classification of entry.

Material, etchant, magnification.

Any special information as desired.

The name, company affiliation and postal address of the exhibitor should be placed on the back of the mount.

Entrants living outside the U. S. A. should send their micros by first-class letter mail endorsed "Photo for Exhibition—May be Opened for Customs Inspection".

Exhibits must be delivered before Oct. 15, 1957, either by prepaid express, registered parcel post or first-class letter mail, addressed:

Metallographic Exhibit
American Society for Metals
7301 Euclid Ave.
Cleveland 3, Ohio, U.S.A.

CLASSIFICATION OF MICROS

(*Optical and Electron*)

Class 1. Irons and steels.
Class 2. Stainless steels and heat resisting alloys.
Class 3. Aluminum, magnesium, beryllium, titanium and their alloys.
Class 4. Copper, nickel, zinc, lead and their alloys.
Class 5. Uranium, plutonium, thorium, zirconium and reactor fuel and control elements.
Class 6. Metals and alloys not otherwise classified.
Class 7. Series showing transitions or changes during processing.
Class 8. Welds and other joining methods.
Class 9. Surface coatings and surface phenomena.
Class 10. Results by unconventional techniques (other than electron micrographs).
Class 11. Slags, inclusions, refractories, cermets and aggregates.
Class 12. Color prints in any of the above classes. (No transparencies accepted.)

AWARDS AND OTHER INFORMATION

A committee of judges will be appointed by the Metal Congress management which will award a First Prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded (with appropriate medals) to other photographs which, in the opinion of the judges, closely approach the winner in excellence. A Grand Prize, in the form of an engrossed certificate and a money award of $100, will also be awarded the exhibitor whose work is judged best in the show, and his exhibit shall become the property of the American Society for Metals for preservation and display in the Society's national headquarters in Cleveland.

All photographs may be retained by the Society for one year and placed in a traveling exhibit to the various Chapters. They will be returned to the owners in May 1958 if so desired.

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METALLURGIST-ATTORNEY: Experienced in research, mill and government practices, desires challenging position in legal or scientific management. Age 38. Presently employed. Complete resume upon request. Registered engineer and admitted to the bar. Box 6-70.

SALES ENGINEER: Licensed metallurgist, 12 years diversified experience in research, production, sale of ferrous, nonferrous, heat treat salts and lubricants. Self-starter, up-to-date, reliable. Patents and publications. Automatic, instrument, textile and electrical background. Good knowledge of heat treat, wear problems and material standards. California location preferred. Box 6-75.

METALLURGIST: Age 33, married, degree. Eight years diversified metallurgical experience in research and production, 5 years with integrated ferrous producer of sheets, tin plate, tubular products, etc., 3 years with independent research laboratory in ferrous and nonferrous metallurgical investigations. Desires position with production-technical responsibilities, Southeast or Southwest. Resume and excellent references upon request. Box 6-80.

METALLURGICAL ENGINEER: B.S. degree, age 25, married, family, veteran. Two years in ferrous metallurgy includes laboratory development work and process control experience, 1½ years in high-temperature and nickel alloy melting and fabrication. Interested in applied research and development and process control. Prefers location near accredited college. Available Sept. 1, 1957. Box 6-85.

MECHANICAL ENGINEER: Degrees and certificates in mechanical engineering, toolmaking, electronics, machinery production. Owned tool shop in Europe, 1927 to 1949. Married, family, recently arrived from Europe. Over 60 international patents on tools, automation devices, etc. Speaks German, Hungarian, limited English being improved by accelerated 8-hr. day course at present. Over 30 years broad experience in all phases mechanical engineering. Desires consulting work, manufacturing trouble shooting, solving problems in large factories, machine tool problems. Box 6-90.

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Two alternative methods are:

1. Write to the original source of the article asking for tear sheets, a reprint or a copy of the issue in which it appeared. A list of addresses of the periodicals annotated is available on request.

2. Order photostatic copies from the New York Public Library, New York City, from the Carnegie Library of Pittsburgh, 4400 Forbes St., Pittsburgh 13, Pa., or from the Engineering Societies Library, 29 West 39th St., New York 18, N. Y. A nominal charge is made, varying with the length of the article and page size of the periodical.

Write to Metals Review for free copy of the address list

METALS REVIEW

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Your reply will be held in strictest confidence and will receive prompt attention.

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PHYSICAL METALLURGIST
REM-CRU TITANIUM, INC.

PHYSICAL METALLURGIST—Sufficiently familiar with various alloy systems to apply background and experience in conducting research on titanium alloys. Studies will include the development of new alloys and heat treatments and also programs aimed at developing basic information about titanium alloy systems.

Challenging, interesting work with excellent growth prospect. Salary open. Liberal benefits. Send complete resume of education and experience to:

H. W. Barnes
Employe Relations
Rem-Cru Titanium, Inc.
Midland, Pennsylvania

HOLDEN SALT BATHS FROM STOCK

LIQUID CARBURIZING BATHS AND CARBON REAGENTS—WATER SOLUBLE

	Case Depths	Operating Temperature Range	
Light Case 50	.001 - .005	1400 - 1650°F.	Carbon A
Light Case 200	001 - .010	1400 - 1650°F.	Carbon D
Hard Case 250	.001 - .025	1400 - 1650°F.	Carbon E
Hard Case 400	.001 - .040	1450 - 1750°F.	
Hard Case 500	.001 - .075	1450 - 1750°F.	
Hard Case 600 for replenishment only		1450 - 1750°F.	

HOLDEN NEUTRAL SALT BATHS WITH ADDITIVES REQUIRE NO RECTIFICATION

DO THE FOLLOWING THINGS:

1. Increase electrode life. 2. Increase ceramic pot life. 3. Increase alloy pot life.

NEUTRAL SALT BATHS with ADDITIVES

Hardening 185-10	1000 - 1500°F.
Hardening 127-11	1300 - 1650°F.
Hardening 127-12	1300 - 1650°F.
Hard Brite AA-10	1450 - 2000°F.

High Speed Hardening Baths with Additives

High Speed Preheat 13-17-10	1200 - 1700°F.
High Speed 17-24AA-10	1750 - 2350°F.
High Speed 17-22AA-10	1700 - 2300°F.
Hy-Speed Case	950 - 1150°F.

NO METHYL CHLORIDE OR CARBON STICK REQUIRED WITH HOLDEN BATHS

TEMPERING BATHS:

Tempering 2	500 - 1100°F.
Tempering 310A, fused	325 - 1100°F.
Tempering 350 Pink	325 - 1100°F.

NON-EXPLOSIVE Tempering Salt Bath 600 to 1200° F. Osquench 3300-10

MARQUENCHING & AUSTEMPERING:

Marquench 296 —

Marquench Additive 356,—to clear up chlorides in austempering-martempering baths.

RECTIFIERS:

Rectifier A—for special descaling operations or added cleaning.

QUENCHING OILS:

Clear Quench Quench 500 Martoil Martoil K

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LEASING CONSERVES WORKING CAPITAL AND INCREASES PROFITS

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THE A. F. HOLDEN COMPANY

3 F.O.B. Points for Holden Metallurgical Products

EXECUTIVE OFFICES AND PLANT
• 14341 SCHAEFER HIGHWAY,
DETROIT 27, MICHIGAN

EASTERN PLANT
• 460 GRAND AVENUE,
NEW HAVEN 13, CONN.

WESTERN PLANT
• 4700 EAST 48th STREET
LOS ANGELES 58, CALIF.